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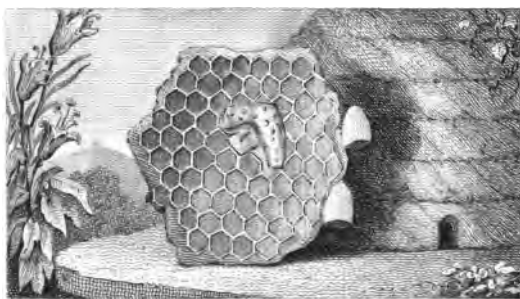
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*Page 32.*

3.



*Page 39.*

**SCENES OF INDUSTRY,  
DISPLAYED IN  
THE BEE-HIVE AND THE ANT-HILL;  
WITH A BRIEF DESCRIPTION OF THE  
WONDERS OF THE INSECT WORLD.**

BY THE AUTHOR OF

"WARS OF THE JEWS," "THE STUDENTS," &c.



"Go to the ant, thou sluggard;  
Consider her ways, and be wise." -- PROV.

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SECOND EDITION.

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# CONTENTS.

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## HISTORY OF BEES.

### CHAPTER I.

INTRODUCTORY Description. Country stroll. A ladies' school setting out for a walk. Sudden terror of the females. One of them taken up and carried by the others. All return home. The Author discovers that they had trodden on a Bees' nest, and been stung. Finds a book. Meets the Clergyman of the village. Gets introduced to the Misses R. Explains that he is studying the economy of Bees. Invites them to see his hives. . . . . p. 1—10.

### CHAPTER II.

A party from the school visit the garden at Long Hampton. Terror of the children at sight of the hives. Arbour and glass hive. Society in each hive, General description of an insect. Insects useful to man. Particular description of the Bee. Explanation of the drawing. Microscopic view of a Bee. Description of the Queen, the Drone, and the Working Bee. Party take leave, after promising another visit. . . . . p. 10—31.



## CHAPTER III.

Duties of the different Bees. The Queen, or Mother Bee. She is despotic, and admits no rival. Not cruel or revengeful. The Males, vulgarly called Drones. Short life. Working Bees have the whole care of the hive. The party examine the hive. Description of the comb, or city. The larger divisions, or streets. The smaller passages, or alleys. The Bees seen building their houses of wax. Account of the cells. Shape and size, purposes, &c. Imitation of a set of cells made with pasteboard. Mistakes sometimes made by the Bees in building, and their ingenious manner of correcting them. Their economy of wax. Number of Bees employed in building. Elizabeth finds out the number of cells in the hive. The party go down the river, and spend a merry evening. . . . . : p. 32—49.

## CHAPTER IV.

Description of the city, or honeycomb. Regular width of the streets. Different sizes of the Workers' and Drones' cells. Royal cells. Occupation of the Bees. The Queen lays in the new cells. Workers' eggs first laid; then Male eggs; then eggs for Queens, in the royal cells. The old Bees go out for honey in March. Nectaries of plants described. Honey extracted by the tongue of the Bee. The honey of some flowers poisonous to Bees, and of some poisonous to man. Lines from Virgil. Description of the honeybag, or first stomach of the Bees, and how they fill their cells with honey. The cream, and the process of sealing up the honey cells described. Prudence and foresight of the Bees. Accuracy of their scent. The use of honey now and formerly. Departure of the visitors. p. 50—69.

## CHAPTER V.

The manner in which the Bees collect pollen. Its use. Of propolis, or virgin wax. What it is, and from what trees ob-

tained. Its use in the hive. Artificial propolis. The formation of wax out of honey. Description of the second stomach of the Bee. What the Bees do when they first enter the hive. The wax makers. The nurses. Description of the larvæ. How, and upon what they are fed. Affectionate care of the nurses. Curiosity of Swammerdam. Growth of the maggot. The nurses stop up their cells, when the second metamorphosis takes place. The pupa, or chrysalis, spins its web. Conclusion.  
p. 69—83.

## CHAPTER VI.

The Author revisits the school. Overhears conversation. Returns with his young friends to the glass hive. Examination of cells filled with pupæ. Progressive metamorphoses. The Queen Bee. Manner of rearing it. Its food. Its unhappy entrance into life. Why more Queen Bees than one are provided. Jealousy of the old Queen. The young Queens kept prisoners by the Workers. When the old Queens are allowed to put the young ones to death. Combat of Queens. One of them killed. Reason why they separated during the fight. A new Queen introduced into a hive. Made prisoner. Fought and killed by the old Queen. Walk to the Castle Lodge. . p. 83—95.

## CHAPTER VII.

Virgil's description of the attachment of Bees to their Queen. Sorrow of the Bees when they first know of the loss of their Queen. How the news spreads. They set to work to repair their loss, and rear Queens from the worms of Workers. Enlarge the cells, and feed them with royal jelly. Their great care. Way of accounting for this extraordinary fact. Experiment to prove that the age of the worms is of no consequence. Anecdote of Bees losing their lives for their Queen. How the

hive is guarded, to prevent strange Queens from entering. On what occasions they consent to receive a new Queen. Their behaviour to her. Anecdote, by Sarah, of the love of Bees to their old Queens. Another, by Letitia. . . . p. 95—110.

### CHAPTER VIII.

Swarming of Bees. What weather it requires. Signs of an approaching swarm. Noises, and reasons for them. The old Queen leads the first swarm. Her appearance and agitation previously. Heat of the hive. Visit to the garden, next morning. Appearance of the swarm. Prevented from flying too high. Where they alight. Stories of brass pans. Want of usual foresight. What happens when two Queens lead a swarm. The swarm hived. Story of Kitty, the maid. Manner of reaching the swarm, if too high. Occupations of the newly-hived swarm. Number of Bees in a swarm. . . . p. 110—127.

### CHAPTER IX.

Enemies of Bees : the Wasp, Hornet, Woodpecker, Titmouse, Swallow, &c. Lizards and Toads. Ants not enemies to Bees. Anecdotes of Ants. Vermin of Bees. Moths the most ingenious enemies of Bees. The Wax-moth. *Tinea Mellonella*. The Death's-head Hawk-moth. The Bees' curious manner of guarding their hives. Fortifications of Bees. Anger of Bees, not confined to man. Murder of Black Bees. Battles of Bees. Invasion of strange Bees. Visits of Bees. Robber, or Corsair Bees. Anecdote of an idiot boy. . . . p. 127—140.

### CHAPTER X.

Additional particulars of Bees. Operations in the hive after the swarm has left it. Young Queens released, according to their ages. Departure of other swarms. State and occupation of the Bees during winter. Ventilation of the hive. The

Bees' fan. Method of taking the honey. Prejudice and ignorance of country people. Different kinds of Bees. Curious particulars of the Red Bee. The Yellow, or Carding Bee. The Leaf-cutters, of various kinds. The Humble Bee. The Wasp. Conclusion.  
p. 140—154.

---

## HISTORY OF ANTS.

### CHAPTER I.

INTRODUCTION. Return of the school party. First visit. New study. Description of Ants; Males, Females, and Workers. Variety of their habitations. Visit to the Ant-hills in the Fir Wood. Description of the Fallow Ant. Building materials. Mistaken notion respecting the wheat collected by the Ants. Pride of Ants. Use of the mound. Manner of building it. Its avenues. Defence of the hill during the night. The entrances blocked up, and guarded by sentinels. How they are opened in the morning. Aversion of Ants to rain. Process of building among the Fallow Ants. Their nests water-proof. The chambers under ground. Mason Ants. Their hillocks. Different kinds of Mason Ants. The Brown Ant. Its industry. Description of the interior of its nest. Twenty stories above, and twenty below. Preparation of the soil. The Ants work at night, and use rain-water and dew. How they work the clay up, and construct the chambers. A sharp north wind destroyed the buildings, and made the Ants desert their nest. Spring the best season for building. Dark Ash-coloured Ant. Its architecture more simple and heavy. Ants do not act in concert, but independently of each other. Instances of this. Enlargement of nests.  
p. 155—176.

## CHAPTER II.

Architecture of the Timber Ants. The Fuliginous species build in the trunks of trees. Description of their nests. The wood of which they are made blackened. The cause of this not known. Vegetation of the tree not injured by the boring of the Ants. Difficulty of making observations of this Ant. Beautiful structure of the cells. Those in the roots of trees not so delicate. The apartments built in arcades. The Red Ants, another species of Timber Ants, who do not blacken the wood of their buildings, and are Masons as well as Carvers. The Ethiopian, or Jet-black Ants, build their houses of decayed wood or sawdust in the hollows of trees. The Yellow Ant, which builds with decayed wood. The Field Ants, and the Sanguine Ants. Their architecture. The Cayenne and the Parasol Ant. The Termites, or White Ants, of Africa. Metamorphoses of insects. Affection of Ants for their young. Instance of their wish to conceal them. Return of the party to the cottage garden. Agreeable surprise. An Ant's nest in a frame. Ants have several Queens. Conduct of the Workers towards the Queen. The eggs. The larvæ described. How guarded by the Workers. Carried out to have the warmth of the sun. Curious changes in the insect world. How the larvæ ask for their food, and receive it. The cocoon of Ants. The pupa state of Ants. The Workers bite off their cocoon. Neatness of Ants. Education of young Ants.

p. 176—192.

## CHAPTER III.

A walk to the meadow. The Winged Ants, or males and females of the Field Ants. Their beautiful appearance. Their swarming. Agitation of the Workers. History of Males and Females, after they leave the nest. Conduct of the Workers, when the Queens, or Females, lay eggs. Affection of the

Workers for their Queens. Conduct of sentinels, when a nest is attacked. Care of the young in time of danger. Herculean Ants. Excursions of Ants. Fetch each other, and converse by means of their antennæ. Anecdote from Dr. Franklin. Migrations of Ants. Inducements for quitting their old hills. They carry each other. Experiments, proving the truth of this. Conduct of the recruits. The forming of a new city, and transportation of the larvæ and pupæ. Half-way house. Empires of Ants composed of several hills. Friendship of Ants. Compliment to Letitia and her companions. . . . . p. 192—203.

#### CHAPTER IV.

Wars of Ants. The arms of the Females and Workers. Males have none. Weapons of those who have no sting. Workers the only warriors. Small Ants attack one larger one: their fury. Battle of Ants of equal sizes. Battle between the Herculean and Sanguine Ants. The Herculeans defeated. Pitched battles between different nations of Fallow Ants continued for several days. Gymnastic exercises of Ants; confined to Fallow Ants. Curious instances of the use of the antennæ of Ants. The food they seek for. They feed their companions at home. How they are supplied with food by the Aphides, or Pucerons. Skill of the different Ants in procuring it. Ants likewise supplied with honey by the Gall insects. How the Subterranean Ants obtain food. The Yellow Ant. Other Ants, who have Pucerons in their nests. How Ants subsist during winter. Their torpid state. Use of the Pucerons in the winter. Eggs of Pucerons. Departure of the party. . . . . p. 204—215.

#### CHAPTER V.

The concert and ball. Farewell visit. The Rufescent, or Amazon Ants. Their warlike habits. Description of an army of Amazons, and an attack made by them upon a nest of dark Ash-

coloured Ants. They steal the larvæ and pupæ. Conduct of the conquered Ash-coloured or Negro Ants. Compound Ant-hills, in which Negro Workers live with Amazon Ants, and perform the office of domestic servants to them. Amazons leave all the labours of the hill to be performed by them, and only fight. Kindness of the Negro Ants to their Amazonian companions. Compound Ant-hills composed of Mining Ants and Amazon Ants. The Sanguine and Negro Ants. The Sanguine Ants more hunters than warriors. Description of Sanguine Ants and their nests. Conclusion. . . . . p. 215—221.



## WONDERS OF THE INSECT WORLD.

### CHAPTER I.

INSECTS not useless. Caterpillars. Their means of defence. Their method of spinning their webs. Agreement of their colours with the hue of their food. Every species has a distinct tree, or plant, to feed upon. Caterpillars and worms food for birds. Metamorphoses of Caterpillars. Their foresight in preparing for their change. The pupa, or chrysalis. Spinning Caterpillars. Ingenious structure of their silken habitations. Butterflies and Moths. Display of cases of preserved ones. Owl Papilios, or Night Moths. Clothes Moths; their ingenuity in forming their nests. Leaf Moths. New Holland Moths. Trap-door Moths. Construction of the Leaf Moth's Nests. The Priamus Moth. Copper Moths. Trojan and Grecian Butterflies. Beauty of their wings. The wings covered with feathers. The Painted Lady Moth. The Purple Emperor. Description of a Fly net. A ready substitute for one. Method of catching and preserving Butterflies. . . . . p. 222—236.

## CHAPTER II.

Silk. Long known, and used in the East, prior to its introduction into Europe. Ancient conjectures as to its nature. Eggs of the Silkworm procured in China, and privately conveyed to Constantinople. Silkworms reared from those eggs, and ultimately carried to various parts of Europe. Method of rearing Silkworms in France. Food of Silkworms. Their transformations. Method of spinning. Anatomical description of a Silkworm. Construction of the cocoon. Length of silk contained in a cocoon. Metamorphosis of the Silkworm into a moth. Winding the threads from the ball. Spiders. Instances of attachment and docility in Spiders. Used as food by some persons. The web. Different kinds of Spiders. Their anatomical structure. Number of eyes. Stings, or horns. Formation of the legs and claws. Ingenuity in contriving the web. Artifices of the Spider to secure her prey. Old Spiders incapable of spinning. Young Spiders will give up their webs to their elders. The Garden or Geometric Spider. Her dexterity in securing large flies. Assists a bee or a wasp to escape, rather than hazard a battle. Spiders' webs in Bermuda strong enough to entangle a thrush. Those in Java still stronger. The Black Spider. Anecdote of a woman who suffered from torturing them. Wandering Spiders. Hunters. Affection of Spiders for their young. Modes of preserving their eggs from injury. Tarantulas. Their bite productive of a kind of madness, which is only cured by music. Gossamer webs. Power of Spiders to shoot up their webs.

p. 236—260.

## CHAPTER III.

An evening walk. Glow-worms. Place of their light. Have the power of extinguishing their light at pleasure. Other luminous insects. Fire Flies of the West Indies. Method of catching



them. Their utility in destroying gnats and mosquitoes. Youthful pranks with them. Lantern Flies. Their utility to travelers. Anecdote. Other kinds of luminous insects. p. 260—265.

#### CHAPTER IV.

House Flies. Anatomical structure of the Fly. Its eyes formed for seeing in every direction. Structure of its wings. Its claws. Velocity of its flight. The trunk, or proboscis. Some Flies furnished with stings. Uses of these stings. Changes experienced by Flies. Annoyance caused by them. The Eye Fly, in India. Gnats and Mosquitoes. Their origin and progressive metamorphoses. Gnats' eggs on a pond of stagnant water. Structure of a Gnat's sting. A Gnat's winter. Annoyance from Mosquitoes in Lapland, France, and the Crimea. Annoyance in America. Various species of them, some of which bite in the day, others in the night. A Persian army put to flight, by a plague of Gnats. Gnats more injurious to man than lions or wolves. The Gall Insect. Different sorts of galls. The Cochineal Fly. Process of cultivating them. Uses of cochineal. Lac Flies. Uses of lac. Conclusion. . . . p. 265—280.

# SCENES OF INDUSTRY.

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## HISTORY OF BEES.

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### CHAPTER I.

ONE Saturday afternoon, I had taken a longer stroll than usual from my cottage, at Long Hampton, which I had made my abode for the summer months. It was May, and one of the pleasantest days of that delightful month. I had reached a little hill, and sat myself down under the shade of a clump of firs that crowned its summit: the prospect, though not extensive, was peculiarly interesting, and the varied objects were strikingly contrasted. On the left, the —shire hills were dimly seen, and their gentle slopes formed a contrast with the bold outline of the range which spread round to the front of the landscape. A thick wood co-

vered the slope of this little chain of hills, and overhung the river, which ran in a gentle stream below. On this side of the river, lay large fields of grass just ready to be cut; and between my hill and these fields, was situated, though scarcely visible for the trees, the rural village of Bray. The bird's-eye view, which my elevated situation gave me, shewed the tower of the pretty grey church, here and there a cottage chimney, a peep at the parsonage, and a full view of the bridge which crossed the river, and formed the high-road to the county-town. Over this bridge, my eye wandered to the right, and followed the river through the golden meadows, till I lost it in the park, when, looking up, I was delighted to behold in the distance, the bold towers which flank the court of the castle.

I was soon tired of straining my eyes to catch the distant objects; and again I looked straight forward to the village. There I observed a large white house, the back of which was opposite to me, and it opened into a garden, walled round, and intersected with broad gravel-walks. I fancied I heard the tinkling of a little bell; and, almost at the same moment, the glass door, which led into the garden, opened, and out issued a number of youthful females, clad in white, with green ribands. "Well," said I to myself, "here is a swarm of

larger bees than I have been lately in the habit of observing. Let me see if their movements are equally orderly with those of my winged friends at home." For a little while, there was, indeed, a great flutter, especially when a lady appeared, whom I soon made out to be a governess; and these young lasses were her scholars. After a few minutes, they ranged themselves into something like order; and, in groups of two or three, linked arm-in-arm, they left the garden, and I lost sight of them.

Once more I ceased to think of all living beings, save the musical inhabitants of the grove; and I gave myself up to the enjoyment of their various notes; among which, to my surprise as well as pleasure, I plainly distinguished those of the nightingale, which is generally represented as so unsocial a bird as to warble only in the hours of darkness and repose.

Just at this moment I heard a loud peal of laughter, as if from a number of merry little beings. I looked about, and to my right, in one of the fields, below the hill on which I sat, I again espied the white and green nymphs, who had issued from the white house. I was near enough to see what they were about, without being myself observed. Some, and among these the elder lady,

were seated upon the gate or palings which were between them and the next field; but most of them were in a cluster busily examining something on the ground. The first peal of laughter was succeeded by one or two others; but soon a sound of a different kind was heard, which evidently disturbed the studies of the elder lady; for she shut the book she had been reading, and joined the group.

I then saw them throng round a very little girl, who seemed to be much and suddenly hurt; and, being unable to walk, two of the elder girls, at the suggestion of their governess, put their hands together, and carried her upon their arms. They proceeded through the gate homewards; but some of the others lingered behind, looking at this same spot on the ground. It seemed, however, they had reason to repent of their curiosity; for I heard two or three more screams, and another girl was obliged to be conveyed home, in the same way as the first; and two or three more evidently limped, or seemed to be rubbing or tying up their arms.

Slowly they returned homewards; and I watched them, till I saw them re-enter the garden. Some carried the lame ones in, others strolled about the broad gravel-walks, while the little ones

betook them to their garden patches ; busily, as I fancied, planting the roots of wild flowers which they had collected in their afternoon's excursion.

I felt a strong curiosity to know what could be on that spot of ground, to cause such a commotion in the group ; and, accordingly, I strolled down the little hill into the field. I had my conjectures, indeed ; and was in hopes the discovery might be of use to me in my studies : for I had come into the neighbourhood on purpose to gain all the information I could, by actual observation, on the history of bees. I was not disappointed : it was a bees' nest, which had disturbed the girls, who, I suppose, before they perceived it, had put their feet too near, and irritated its inhabitants ; and they had avenged themselves by stinging the limbs of the intruders.

The dusk was approaching, and the rising damp warned me to depart. I therefore postponed the examination of this nest for some other opportunity. In looking about, for some mark, by which I might remember the spot, I observed a book lying in the grass : " Oh, oh ! " thought I, " the poor wounded one forgot her book in her distress ! Well, let me see what her name is." I took up the book, and saw on the outside, in neat gilt letters, " Letitia Welbeck.

Second prize. Reward for Good Conduct." On opening it, I found it to be the "Cabinet of Curiosities."—"This will be a terrible loss," said I; "I must endeavour to find out the young lady, and restore it to her."

With this intention, I took the way to the village, with the book in my hand. But I could not make up my mind to knock at the door of the large white house. "It would be too formidable," thought I, "to have to encounter, perhaps, two or three grave governesses, and a whole host of girls; how should an old bachelor, like myself, know how to behave among them?"

While I was thus musing and sauntering, I reached the village, and found myself close to the garden-gate of the vicarage.

I had never walked down the village before; and while pausing to look at the pretty little church, one side of which stood in the vicar's garden, I felt myself tapped upon the shoulder; and, on turning round, found it to be the curate of the village, in which I was for the time residing.

He was accompanied by a grave-looking elderly man, whom he introduced to me as the vicar, whose house and church I was admiring. "Why, my bee-hunter!" said my lively friend, Wellingford, "what are you doing here, so far from your

hives? Have you borrowed the wings of one of your little companions, and flown across the fields?"

The grave-looking clergyman glanced his eye upon the book I was carrying in my hand. "A lady's name!" said he, in a very quizzical tone: "Your friend has been conning a favourite lesson, Wellingford!"

Being little disposed to be the butt of a joke, I hastened to tell my story; and to express my anxiety to restore to the little girl her lost prize.

"Oh, if that be all," said the vicar, who had exchanged his solemn look for one of great drollery; "if that be all, I will put you under my wing, and introduce you to these '*grave ladies*!'" So saying, we walked along; and, turning the corner which led out of the village, were almost directly in front of the white house. The front was far prettier than the back, being something like an Italian villa in miniature; a semicircular plot of grass, flanked by shrubberies and groves, led up, on each side, to the entrance. As we entered, the gate shut upon us, and we were soon at the steps. These were covered with geraniums, in full bloom, and other plants, apparently fresh from the green-house; the windows on each side of the steps reached the ground, and were en-



veloped with monthly and Austrian roses, mignonette, and French honeysuckle.

I am such a lover of nature, that I was put into good humour by these tasty decorations, and prepared even to encounter the "grave" looks of the governess; but, when I followed the vicar into a small but elegant pink-coloured drawing-room, and saw myself approaching a graceful and handsome female, neither grave nor formal, but gentle, and almost sprightly in her manner, I felt quite perplexed. Near the window sat a blooming and merry-faced young lady, with her drawing apparatus before her; and at the harp sat another female, whose features were of a graver cast, but whose tall and commanding figure looked exceedingly graceful, when bending over the harp, which she was in the act of tuning.

I was introduced to all these severally by the vicar, in a half-serious, half-humorous manner; and I soon made out, by the smile which appeared upon the faces of all the ladies, that they were accustomed to consider him as a regular wit.

He took the book out of my hand, telling the ladies how anxious I was to shew a due sense of honesty; and related my tale in so droll a manner, that we all had a hearty laugh; after which, I felt myself very much at home.

Miss R. the elder governess, said, she believed the young ladies were in the garden; and that, if I liked to take a stroll round the grounds, I might have the privilege of restoring the book myself to its right owner.

We formed a party immediately; and, after visiting the green-house, &c. entered the garden behind. At the bottom of a broad gravel-walk, in a kind of stone arbour, with her foot on a cushion, and surrounded by young companions, I found the little girl, whose book I was in possession of. She was much pleased at seeing her book, and thanked me for bringing it. I told her, I was sorry that my friends, the bees, had proved such great enemies to her; but that I thought a sight of them in my hives at Long Hampton would almost reconcile her to them.

We then pursued our walk; and, after much agreeable conversation, I began to think I must not intrude any longer. As we approached the gate, I found Wellingford making the two younger Misses R. laugh at my expense, by describing the furniture of my little cottage at Long Hampton; the various shaped and various sized hives, the swarms of bees, &c.

To escape from his jokes, I took a hasty leave; but not till I had invited the ladies to come and

see my bees, and to bring with them some of their pupils, who had been stung, that I might endeavour to reconcile them to each other.

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## CHAPTER II.

A FEW days after this little adventure, I received a visit from my reverend neighbour Wellingford. I was in the garden, among the hives, and watching the labours of my bees. With my head bent down to the windows of the hive, I was not aware that any one was passing the low paling that separates my garden from the lane, till I felt the tap of Wellingford's whip on my shoulder. He was booted and spurred, and had apparently just dismounted from his horse. "Prepare," said he, "prepare your hive, my good friend, for there are visitors for you on the road; bid your bees trim their Sunday suits, and tune their merriest hum."

I was glad of this friendly warning, as it enabled me to make some few arrangements in my little domain. I ordered chairs to be brought out and placed in the pink hawthorn arbour, which, being now in full bloom, looked very gay; and thither I

had my glass hives transported, that we might make our observations unmolested by the sun.

The little group presently made their appearance, accompanied by the elder Miss R.; and I hastened to the garden gate to receive them. I soon spied the wounded Letitia among the number, and was glad to find that she was able to walk again; but I remarked that she trembled whenever a bee came buzzing near her. On this account, I led the party in a direction contrary to where most of the hives were, and introduced them into the arbour, in one corner of which stood my hive, which looked like a box with glass windows, and on a little table were placed my various sized microscopes.

“I am unwilling,” said I, “to introduce you at once to all my hives, lest the bees that throng about them should occasion terror to the young ladies, who have so lately suffered from their stings; but I hope first to say something in their favour, by way of conciliation; for, though always armed, they use their weapons only in self-defence. For, you must remember, Miss Letitia, that your foot, planted upon their nest, must have appeared to them like an invasion from a terrible enemy.

“When I shew you that these little beings unite

together to make themselves houses and towns, and that all their labours are carried on in a most regular and clever manner; that they have a queen, whom they obey and guard; I think you will agree with me that the bee is the most intelligent of all insects.

“The society in each hive is composed of a number of drones, a still greater number of workers, and one queen, besides the young brood, which is an object of care and attention to all the others.

“As there is as much difference between the form and appearance of these several members of our insect society, as between their duties in their little establishment, I will first make you *personally* acquainted with them. Do not be alarmed, however; I will not open the door of my hive, and suffer them to buzz around you: the recollection of her wounds would deter *one* at least of my young audience from a quiet examination of their bodies. No, you shall study them first from the contents of my portfolio, and learn to admire the various parts of their frames, so curiously adapted to assist their still more extraordinary instincts. I may then venture to open my cabinet of real, though not living insects; and I predict that, before very long, the curiosity even of Miss Letitia herself will so far overcome her fear, that she will

assist me with her own hands to place a living bee under the glass of my microscope."

I perceived that my young friends all rather shuddered; and, with a smile of doubt on their countenances, they watched me as I entered my cottage.

"Those who have observed bees flitting from flower to flower, in a garden," said I, "and buzzing about with all the noise and bustle of labourers, have looked upon them with admiration, perhaps, for their golden rings, glittering in the sun, mingled with terror of their invisible weapon; but, without a much nearer examination, they can have formed very little idea of the wonderful construction of their limbs. But this insect did not start into life with all its parts perfect as you behold them."

LETITIA. "I thought an *insect* meant merely a crawling thing, such as a worm or caterpillar: I find I must be ignorant of the exact meaning of the word *insect*."

"The word *insect* comprehends all creatures furnished with a head, antennæ,\* and six or more feet. Insects breathe through holes, or pores, in the sides of their bodies; their skin is hard, and serves them for bones, of which they have none;

\* *Antennæ*, horns, or feelers.

but their principal distinction consists in their *antennæ*, which differ from the horns of other animals, in being jointed and moveable.

“ All insects make their first appearance in the world in the shape of *ovi*, or *eggs* ; they then go through three metamorphoses, called the *larva*, the *pupa*, and the *imago*.

“ The *ovum*, or *egg*, I need not describe to you ; the *larva*\* is the grub, or worm state. It is a Latin word, signifying *mask* ; because the insect appears to be masked. Some insects are only a few days or weeks in this state, while others remain in it for months or years. When about to quit it, they cease eating, and, fixing themselves in a safe place, cast off their outer skin, and disclose an oblong body. They are now in their third, or *pupa*† state, in which each looks like a child in swaddling-clothes ; for they have a thin skin over them, which, in the bee tribe, covers each limb separately. They eat nothing in this state ; and are without motion.

\* Formerly called *eruca*, the Latin for a caterpillar.

† *Pupa*, (Latin) a baby, or doll : formerly called *chrysalis*, (Greek,) and *aurelia*, (Latin) both signifying *golden*, from the golden colour of some insects when in this state. It is also called *nymph*, from the Latin *nympha*, a name given by Pliny to a young bee before it can fly.

“ Some species of insects remain in this state for a few hours, others for weeks, months, or years; and when it has reached its full size, it bursts its case, and enters the fourth, or *imago* state. This word is used, because the insect, having laid aside its various masks, becomes now a perfect *image* of its kind; whether it be a fly, bee, or, in short, any insect you behold.

“ Let me trace that beauteous butterfly, which you, Miss Letitia, are so longing to chase, from the first moment of its existence. When it burst its first habitation, the egg, it was a caterpillar, crawling upon sixteen short legs; with twelve eyes, so small, that even my excellent microscope would scarcely enable me to point them out to you. With its two delicate jaws, it devoured my rose-leaves. Next, behold it a butterfly, and, instead of jaws, provided with a curled trunk, or proboscis, with which it sucks up the sweet juices of flowers; ten of its sixteen feet have now disappeared, and the remaining six have changed their form, while two long horns grow out of its head. Its twelve small eyes have vanished, and, in their stead, appear two very large ones, composed of innumerable little surfaces, or lenses, each of which serves as a distinct eye. The internal structure of the insect undergoes a change



as wonderful as that of the external; but the examination would be too minute for us."

LETITIA. "And did this wonderful change take place all at once, or by degrees?"

"It remained in its middle, or pupa state, for some weeks. At length the skin broke; and from a case not an inch long nor a quarter of an inch in breadth, burst out the butterfly before you, measuring at least four square inches.

"Wonderful as this metamorphosis is, there are numbers of others equally so: that shining beetle, which is crawling so leisurely along the window-seat, and which one could almost fancy to be vain of its glossy clothing, lay for many months beneath the surface of the earth, a mere grub.

"The gnat, whose buzzing haunts you in your very bed, was at first an inhabitant of the waters, in form more like a fish than a fly. Now it can live only in the air. It formerly breathed through its head; now through pores in its sides. Its head was then without shape; it is now provided with antennæ, and with a trunk, which, while it pierces your skin, contains a syphon, or pump, with which it sucks up the blood.

"That pretty little, lively, active creature, that fly, Sarah, which you in vain try to trace in its flutterings, would have disgusted you, had you

seen it in its former state, as a grub, wallowing in dirt and manure, destitute of eyes, or wings, or legs!

“Such are the wonderful changes that the bodies of insects undergo; a very few instances of which I have given you. That they are destined to undergo them from the moment of their first existence as an egg, is certain; but why they are so, cannot be understood. That such is the will of their Maker is the only satisfactory explanation in my power to give. And that you, and I, and all of us, shall undergo some analogous change, when this *mortal* body shall become a *spiritual* body, we have the assurance of Holy Writ.”

My little auditors expressed their astonishment at what I had related to them. “Oh!” cried Letitia, “I never could have dreamed that so many curious facts could have been told me about such insignificant and useless little things as insects!”

“Useless! Forgive me, Miss Letitia, if I hope to convince you, that insects are far from being useless. And let me remind you, that, though smarting from the sting of a bee, you should not forget the sweet treasures, which it collects with great toil, and of which it is robbed for our pleasure and use.

“I can assure you, that many insects are useful to man, in various ways: there are whole

tribes, whose office it is to attach themselves to the dung of animals, of which they consume all the liquid and offensive particles, leaving only a dry mass, which, thus rendered light, can be scattered abroad by the wind, instead of remaining a putrid and pestiferous heap. Beetles by hundreds are thus employed; and it is a singular fact, that their shining skins are never soiled by their filthy office. Other species of insects render a similar service, by devouring the carcasses of animals. The air would be unfit to breathe in, were all these suffered to become putrid; no sooner, therefore, is life departed, than swarms of insects take possession of the body. First come the *histers*, little flies, which pierce the skin: of the holes they make, the *flesh-flies* take possession, and while some deposit in them their already hatched young, others fill them with multitudes of eggs, which are hatched and produce devourers in the course of a few days. A single flesh-fly will lay 20,000 eggs;—and thus it has been said, ‘three flies will devour a dead horse as soon as a lion.’

“Beetles, wasps, and ants, second the labours of these industrious devourers, and convert the carcase into a skeleton, the more perfect clearing

of which they leave to insects of a still minuter kind.

“ There is an useful little creature, called the *burying beetle*, which collects a party of its own kind around the body of a dead field-mouse, or other small animal, and inter it.

“ Insects are of use in another way, of which, perhaps, you will hardly comprehend the true value. You have probably read of the immense forests, in the torrid regions particularly, which cover whole acres of ground, where the hand of man never penetrates. Trees fall there, either from old age, or from being stricken by the storm and the lightning: but no confusion takes place—no unwholesome vapours fill the air. The bark-boring insects take instant possession of the fallen trunk; through the holes they make, the rain enters; and the moisture, combining with the heat, by degrees decomposes the tree: fungi then take possession of the wood, together with insects which feed upon decayed bodies; and in a few months, the whole immense trunk is turned into a heap of dust, which forms a rich manure for the earth, and young trees shoot up in its place.

“ It is true, that some insects are equally in-

jurious and annoying to us; in some seasons, these would become too numerous, were it not for other insects, who, by destroying them, confer another kind of benefit upon us.

“Of these insect-destroyers, some are so while in the larva state only; others, while in the imago state: and there are others who are so during their three states of larva, pupa, and imago. Some insects will destroy others of a larger kind: a sand-wasp has been known to attack a spider eight times its weight; and he even attacks the blatta, or cockroach. The battle between these two insects is very curious. They stop when they approach each other; they look at one another; then the sand wasp darts upon the beetle, seizes upon its muzzle with its stout jaws, bends its abdomen underneath it, and in this posture stings it severely; then, conscious that he has sent a deadly poison into the body of its prey, the sand-wasp flies away; but when the poison has taken effect, and rendered the enemy motionless, he returns, seizes it by the head, and drags it into some hole or secret corner.

“The aphides, those insects which feed upon leaves, and devour so much of our tenderest and most lovely foliage, themselves afford food to various other insects. The beautiful four-winged

fly, whose wings resemble the finest lace, is termed the 'Lion of the Aphides.' The grubs of some flies feed upon aphides: armed with a three-pointed mandible, a little trident, in fact, with which they stick their prey, you may see one on a leaf, surrounded by hundreds of aphides, devouring one after the other of the helpless prey, which never attempt to escape. The blind grub, after fastening itself by its tail, gropes about for one of its prey, which it sticks upon its trident, holds it up, as if in triumph, and swallows it.

"Observe that flourishing gooseberry-bush, Miss Letitia; a few days ago, its leaves were all coiled up, and I had every prospect of a withering blight to spoil my young and tender shoots; but the labour of a few *aphidivorous* flies, as they are called, have cleared my leaves, and the young shoots are again vigorous.

"Among the most useful insects, I must class the pretty *lady-bird*, which devours its thousands and tens of thousands of the destructive aphides. The hop-growers derive so much benefit from "the fly," as they call the useful lady-bird, that boys are hired to prevent birds from feeding upon them.

"Ants, wasps, and hornets, are among those insects which destroy their own kind in every state.

An ant will drag a wild bee larger than itself. In the island of Antigua, there is a kind of ant, which forms its nest in the roofs of houses; and which, when it meets with an animal it cannot master alive, such as a cockroach, it seizes it by the legs, and holds it fast, while other ants mount upon its body, and kill it: they all then assist in removing it into the nest.

“ Wasps and hornets, useless as you may think them, are of service in devouring flies; particularly flesh-flies.

“ Besides these, there are others, which may be called *cannibal* insects, since they live upon those of their own species. The most ferocious of these are the *mantes*,\* whose fore legs are formed like a sabre, and are almost equally serviceable in cutting off the head of an enemy. It is one of the amusements of the Chinese children, to sell to each other little bamboo cages, each containing a mantis, and turning two of them in together to fight. Yet these very insects, who are such ferocious fighters, have, in some countries, a character for gentleness and piety, from their sitting with the fore legs bent, a posture they assume for the purpose of watching for their prey. Some super-

\* From the Latin *mantis*, a diviner, or prognosticator.

stitious persons assert, that if a traveller loses his way, he has only to seek for one of these insects, and follow the path it indicates. One species of the mantes is almost worshipped among the Hot-tentots, who deem a person lucky if such an insect happen to fly upon him.

“Other insects there are, which are useful to us, as supplying food for birds of various kinds. The kestrel, a bird of the falcon tribe, chiefly lives upon beetles and grasshoppers: the butcher-bird, too, which seizes an insect with the sharp thorn of a sloe, and impales it alive before she eats it. Rooks devour grubs, one kind in particular, which abounds in meadows; and for this reason the rook is seen to follow the progress of the plough. The farmers in Virginia were so foolish as to spend a large sum of money in getting rid of the little crows of the country; but afterwards found themselves in such need of their services, that they would willingly have given twice the sum to have them restored.

“Almost all our warbling birds feed upon insects. How should you, Miss Letitia, like to be deprived of your favourites in yonder grove? How solitary would you feel! How much of its animation and joyousness would the spring lose, without the *society* of singing birds!



“Some of the dainties of our table, too, the wheatear, and others, are provided with food from among the insect world: the swallow, our most companionable bird, spends the day in searching for them. In dry and clear weather, they seek them in the skies: when the atmosphere is moist, they find them on the surface of the water, or near the ground. Thus the swallow becomes our weather-glass. I have a nest of swallows beneath the thatch of my cottage, and close beside my bed-room window: often do I watch the return of the parent swallow to her nest, where she pops a delicious juicy insect into the open expectant mouth of one of her brood, then darts away in quest of others, to satisfy all in their turn. Hundreds of tiny insects does she daily bring for the sustenance of her offspring.

“Some few plants, too, are supposed to derive their nutriment from insects. Some have the singular faculty of entrapping flies, by means of their little stamens, which close upon them when they touch them. The leaves of other plants form hollow vessels, which are filled with water, and into which insects are enticed by its carrion-like odour.

“These few instances may serve to shew you, my young friends, that, however insignificant in

our perception the insect tribes may be, they are, in the scale of nature, far from useless. To convince you of this, I will begin with the history of the bee, her extraordinary instincts will convince you, that she could not have been made in vain; and even if she should fail to convince you, I have other stores in reserve.

“The bee is of the Hymenoptera\* tribe of insects, which includes all having four wings and a sting in the tail. It is about three quarters of an inch long; its four curiously shaped wings have strong membranes, or fibres, round and across them, to add strength to the delicate texture of which they are composed. It has six legs, a large head, and thin neck. Its waist, or middle part, is likewise very slender.

“The bee is provided with two instruments of defence, or war; for, besides its sting, it has teeth, placed within its fangs, or mouth, which meet vertically, not one over the other as our own. With these teeth, the bee seizes any robber, who dares to invade the general store of honey, and holds him prisoner until another comes and pierces the body of the enemy with his formidable sting.

\* Hymenoptera, from the Greek *hymen*, a membrane, or fibre, and *pteron*, a wing; that is, having membranaceous wings.

“To us, the wound occasioned by the sting of the bee is only painful, not dangerous; but to creatures of the same species, it brings certain death.”

LETITIA. “Is it true, that a bee never lives after it has lost its sting?”

“Yes,” replied I: “their sting is fastened to their bowels; and when they leave it behind, which, if the person stung gives a sudden start, or jerk, they are very liable to do, they leave their life with it. I really believe a bee would live longer after being cut in half, than when deprived of its sting.

“This little sword of theirs is pointed, and very sharp; and the bee can make it penetrate through very hard and tough substances. Your stocking and glove, Miss Letitia, for instance, you would imagine to afford a tolerable resistance against so minute a dart; especially, since it is in fact a hollow tube, containing the poison in the middle of it, as we will by and by ascertain by means of our glasses.

“The eyes of bees are large; but being protected, or covered, by a thick horny substance, they are very dim-sighted.

“To compensate for this imperfection, they are provided with antennæ, or horns, which project

from above their eyes, and have each one joint in the middle, and another near the end, so that they can be pushed forward or drawn in at pleasure. With these antennæ, which serve them as hands and fingers, the bees can touch whatever object is too minute for them to see, and are enabled to be as expert in chasing away intruders by moonlight, as in cutting their way through the air in open day.

“ Look through this microscope, and you will discover the tongue of the bee: being too long for its tiny mouth, it is doubled over upon its breast, down which it spreads to a considerable distance.

“ This tongue is as curious in its construction, and as useful to our little insect, as any other of its members; for with it, the bee not only provides itself with food, but collects the stores of honey which it hoards in its combs. The shape and size of the tongue varies in every different kind of bee; sometimes it is composed of one single piece, and sometimes of three, five, or seven pieces. The outer parts of the tongue are protected by sheaths, of a horny kind of substance, folding over each other, whose little valves, or doors, are ranged in pairs on each side. The tongue itself is porous, and imbibes the juices of the flowers,

which the bees sip from the nectaries, and which are afterwards converted into honey."

MISS R. "Have you never observed, Letitia, the bee, when he perches upon a full-blown flower, put out his little tongue, lengthen it and then shorten it, draw it in, and turn it about in all directions? Its movements are really quite entertaining."

Letitia, as I expected, acknowledged that she had never had the courage to stand near enough to examine all this; and I continued my description.

"You will observe too, for I am rather proud of my glasses, the innumerable fine hairs which cover every part of its body, like that of a fox; even its very eyes are covered with the finest hair, which, without a glass, you would never have suspected. In the hinder part of the bee we are examining, you may discover the bottle, or bag, in which it carries its honey, which, by the help of muscles curiously adapted for that purpose, it empties into the honeycomb. In this bag our little friends often fetch up water, to dilute their sandarach, or bread, the food they provide for their young.

"Are you satisfied with this general description of a bee? Or may I flatter myself that I have so far interested my young friends, that they are willing to listen while I describe the varieties

which distinguish the *persons* of the queens, the drones, and the workers?"

My auditors expressed their willingness, nay, even their desire, to hear more; and it may be considered as a proof that we were all engrossed with one subject, that we had not before perceived that Wellingford had deserted the group, and was trotting down the hill, within sight, though already at some considerable distance from us.

"The queen bee then, or female, whom I think I may call the noblest of all insects, differs from all her subjects, in having a longer body, tapering off at the end. Her wings, however, are short, which shews that she was not intended by nature for long flights, or a life of labour. The hair on her back resembles a velvet or fur cape, and is of a rather lighter brown than the rest of her body. The end of her body is jet black, and glossy as polished marble; her two principal legs and stomach are of a golden hue, in which respect she far outshines the other inhabitants of the hive. Virgil, the poet of the bees, describes her as—

——— godlike to behold,  
Her royal body shines with specks of gold  
And ruddy scales.

"But we must remember, that the colours of the imagination are often more brilliant than those of

nature, and that Virgil in this instance painted with the former.

“The drone, or male bee, is as large again as the workers, and the reverse of the female, his body being short, thick, and clumsy, and very obtuse at each end. His eyes are large and very near together; between them, however, are situated the antennæ, which in the drone has as many as fourteen joints, some so small as to be nearly imperceptible. His wings are long, his legs short and thin, and his voice so loud and *dreadful* as to occasion much needless fear.”

LETITIA. “Ah! how can you say needless? Think what I suffered from his terrible stings!”

“True, Miss Letitia,” replied I, smiling at her almost indignant countenance, “you found an irascible enemy in the bee, but it was not the drone; for, singular as it may appear to you, this member of the family of bees is not provided with a sting; and henceforward remember, that the deep-toned buzz, awful as it has hitherto been to your ears, need no longer convey any cause of alarm.

“The drone is, likewise, incapable of assisting in the labours of the workers, from the shortness of its tongue, which is not long enough to reach the honey out of many kinds of flowers.

“The workers differ little from the drones, ex-

cept in being much smaller, and in having a sting, and one additional joint to their antennæ."

I was about to begin describing the various duties of the several classes, when Miss R. interrupted me ; and, after thanking me, in much too grateful terms, for the instruction I had already given her young pupils—and, indeed, she modestly added, to herself,—observed, that the time she had allotted for their visit was expired ; and that her sister Jane, with another detachment of young ladies, would be already looking out for their approach to Oakley Wood, the rendezvous for that afternoon. A promise of another visit shortly, reconciled me to their departure ; especially, since I had the satisfaction of observing, that one or two of my new acquaintance, and among them Letitia, cast a wistful look at my hives, as they retreated after Miss R. through the garden wicket.

" I have excited your curiosity, at least, my little friends," said I to myself, as I replaced my portfolio in its customary nook, and enclosed my microscopes in their cases, and ranged them in due order on the chimney-piece.



## CHAPTER III.

“CURIOUS, as I perceive you are become, to peep into the windows of my box hive,” said I, addressing my new acquaintances, whom I had the pleasure of seeing, a few days afterwards, again seated round my garden table, “I cannot gratify that curiosity, until I have given you some idea of the economy of a hive, and of the relative duties of the bees.

“You must prepare for the history of a laborious and indefatigable race, governed by their own laws, to which they are strictly obedient, full of foresight, and entirely devoted to the good of the public.

“The monarchy of the bees, in fact, has been thought worthy the attention and investigation of clever men from the most ancient times. Most of these have aimed at discovering a true knowledge of them ; but, until of late, many points of their history have been wrapped up in great obscurity ; and, strange to say, it is to a *blind* man of the present day, Mr. Huber, of Geneva, that we are chiefly indebted for discoveries which throw light upon their proceedings.

“ I shall endeavour to avoid, as much as possible, the fables which have been plentifully handed down to us from time immemorial, though, I doubt not, you will consider what I do relate as sometimes sufficiently marvellous.

“ The queen, or mother bee, is the only female in the hive who lays eggs. She generally lays between thirty and forty thousand in a year. Her existence is therefore most essential to the hive, and her subjects, whose instinct teaches them this fact, spare no pains to protect and cherish her. The queen is despotic in her hive, but the chain which unites her to her subjects, is linked by affection. Long habit endears even her person to them ; and they resent any attempt to exchange her and put another queen into her place. The queen herself will admit of no rival, and fights any other queen who invades her kingdom, or aims at sharing its honours. Except on such an occasion as this, however, her disposition is truly queen-like ; and she behaves, as if conscious of the importance of her life, in a dignified and pacific manner, not risking it by giving way to every impulse of anger. The sting with which, as I have before told you, the queen is armed, inflicts a more painful and deeper wound, than that of the other bees ; but she never makes use of this weapon unless she has

been severely provoked. I have handled her, turned her about, and teased her in various ways, without having ever received the honour of a royal sting."

MISS R. "I must allow, that this disposition partakes of a truly royal character, which ought to be slow in inflicting vengeance; but when it does so, should let the punishment be sufficiently severe to deter others from offending in a similar manner."

No one being inclined to dispute the justness of this observation, I continued,—“As to the drones, those notorious idlers, whose very name is held in such contempt, that to call a person a *drone*, is quite an insult; they are, in fact, the many thousand husbands of the one queen. Their life is very short: they make their appearance in the hive early in May; they increase rapidly in number from that time; live a life of ease and luxury, without labour, and feed on honey, the most dainty fare the hive can afford. At length, weary of supporting this race of idlers, now no longer of any use to the community, towards the latter end of July, the working bees begin to chase them, and, hunting them down to the bottom of the hive, where they take refuge in great numbers, they put them to death with their stings.”

LETITIA. "I begin to fear these working bees, industrious as they may be, are not very amiable."

"This, perhaps," I replied, "is not the most pleasing trait in the characters of the workers; but have patience, and this impression of their inhumanity, will, I am convinced, give way to admiration and astonishment. But how shall I begin my description of these extraordinary little beings? Who, in fact, could explain to you the *language* by which they communicate with each other, arrange their plans, and give laws to their little kingdom?"

"The working bees have the whole management and care of the hive; they clean it, and guard it from robbers; they collect stores of honey and wax; they build cells, which serve as nurseries for their young, whom they rear with the most tender care. The history of this active race has filled many a volume; but I promise you more entertainment than any book can afford, if you will now venture to follow me to the hive, where we can study its history with our own eyes, from nature's inexhaustible pages."

Curiosity triumphed over fear in the minds of my auditors; or rather, perhaps I ought to say, a laudable pride enabled them to summon up their fortitude, and prevented them from betray-

ing any remains of fear, which might still be lurking in their minds. I stationed myself nearest the door of my box-hive, and ranged my visitors at the glass windows all around. My hive was formed upon the most newly invented plan, and afforded every facility for making observations.

“Here is a city,” said I, “composed, probably, of eighteen or twenty thousand inhabitants; you already know that these consist of one queen, many nobles, and still more labourers; let us see what kind of houses they live in.”

“I see,” cried Letitia, who was anxious to shew her newly-acquired courage, “rows of little cells, ranged one above another. Do the bees live in these?”

“These,” I replied, “are their houses; and between the rows of these, you observe in some parts space enough to admit two bees abreast; these we will call streets; and those still smaller subdivisions, which cross and intersect the city in every direction, courts and alleys. And now for the inhabitants of this busy world: can you make out at all what they are about?”

LETITIA. “I should say, that some of them seem employed in building up again the broken or decayed walls of their houses. Pray what kind of bricks and mortar do they make use of?”

“ It is wax, with which they build their houses ; but this curious substance will deserve more attention than we can give it at present ; for I am anxious to explain to you the formation of their honeycomb, or, as I have named it, their city.

“ This, as you have remarked, consists of a number of small cells, or houses, and is not the least wonderful proof of the skill of our little friends. Their grand aim, in the construction of a city, would of course be to get as many houses into as small a space as possible.

“ To effect this, and to form the cells upon one regular plan, they have done what the most scientific men, with all their reflection, have been unable to effect ; and they have done it in such a manner as best to answer every purpose for which they wanted their houses, namely, the depositing of their eggs, rearing their young, and laying up stores of honey for winter use.

“ Now, before we decide as to the excellence of their performance, let us first consider how we ourselves should set about building a habitation for bees. In the first place, what shape should the cells be ?”

LETITIA. “ I should say round, because that would be most suitable to the form of the bees themselves.”

“ Very well ; but just cast your eye upon this paper : I have drawn two or three round or circular tubes ; you see they do not join well, and there is considerable room lost in the spaces between them. This would not, I think, be approved of by our little economists.”

LETITIA. “ I perceive that objection ; but what do you say to square or triangular houses ; the sides of which, being flat, would fit into each other ?”

“ There is one objection to either of those ; namely, that the bees would not fit in well, and the corners would therefore be all loss of room. Let us see what the bees themselves have fixed upon, and then we shall, with humility, acknowledge their superior skill, or that rather of Him who gave them their instinct.

“ The number of bees, all collected and hovering about, will perplex us too much to allow of making our observations from the hive itself ; we will therefore turn once again to the table, and examine this piece of dried comb, which I have purposely cut through the middle.

“ Each cell has, you perceive, six sides, or is hexagonal, as it is called : this form unites the advantages of being flat sided, with that of being so

nearly circular, as to leave very little space unoccupied when the body of the bee is within it."

MISS R. observed, that this form spared wax as well as ground; since, if the cells were circular, there must be a separate wall to each; instead of which, one wall serves for two houses.

"There are other equally skilful contrivances in this comb, which we should have attempted in vain. Each cell must, you know, have an opening at one end to admit its inhabitants; the bees, therefore, with true economy, build a double comb, in which ranges of cells are placed back to back, one bottom serving for both sets of cells.

"This method of building unites to perfect neatness and economy, great strength and firmness, which you will find peculiarly necessary when you hear how delicately thin they build their waxen walls, and what a store of honey they pack up in each cell.

"If we had been the architects, we should, doubtless, have fancied that flat bases would have served every purpose, would have required as little time, as little trouble, and as little wax, as any other kind. Not so our rival masons. To economize their wax, the hard earning of many and many a day's gleaning from many thousands



of flowers, they have discovered the superior advantage of a pointed or pyramidal base, which enables one set of cells to fit into the opposite set.

“ Here you perceive a double row of hexagonal tubes, united by one pyramidal base, but mark the difficulty in the building of this remarkable fabric. Let us try one ourselves. Take this card, for instance ; double it into three parts, and bend those again in the middle ; cut each end to form a vandyke ; bend the card round your finger till it meets ; and then you will find that you have a six-sided tube, whose base is formed by three hollow triangles. Now, a double triangle is properly called a *lozenge* ; for I will not offend you by not using scientific terms.

“ Cut three lozenges, therefore, to fit in the three hollow triangles, and place them together, thus ; and you form a little cup, which serves as a base to one cell, and to the half of two of the opposite cells.”

Letitia declared she could not boast of much skill in geometry ; but I perceived that she understood the terms I made use of ; and her wish to enter fully into the subject, united to a tolerable share of penetration, made her at length understand me ; so that, by means of a few cards, and a

needle and thread, we had soon a tolerably exact set of cells upon the table before us.

"These," said I, "serve as examples, though rude, if compared with the perfect angles and smooth surface of the waxen comb itself."

"I see," cried Letitia, "that we have made one set of cells, whose bases are pyramidal, or hollow, but the opposite set will surely be just the reverse?"

"Let us," said I, "turn the honeycomb to the other side, and we shall see how curiously, yet simply, the bees have obviated this difficulty.

"Observe, that the pyramidal points on this side, enter the hollow triangles of the other; so that the three lozenges which form the bottom of this cell, are each of them one of the lozenges belonging to the bottom of a separate cell on the other side. Stick a pin, for instance, into each lozenge which forms the base of this cell, and tell me where to find the points."

LETITIA. "Here they are, each in a separate cell. How very neat and curious! Look, dear Miss R. there is not an atom of wax or room wasted in this lovely fabric!"

"You are becoming a willing admirer of your enemies, Miss Letitia," said I, smiling at the rap-

ture with which she held up the honeycomb to her governess: "they are indeed extraordinary architects, especially since they do not proceed mechanically with their work; but, like mortals, make occasional mistakes, in the correcting of which one would almost declare they employed reason and judgment.

"You observed them in the hive, apparently plastering up holes, or repairing walls. In fact, they have often much to mend; and, accurate as the bees are, their six-sided habitations are sometimes very crooked and irregular. They often begin their work clumsily; and their cells, when they first begin, are ill formed; but they soon find out their error, and try to improve as they go on; so that the opening of the cell is almost always regular and symmetrical.

"You would imagine that an irregularity in one cell, would cause all the others to be thrown out of place: but the bee is too sagacious for this; and if one cell be too large, you invariably find the next proportionably small.

"Sometimes, they make their pyramidal bases of four lozenges instead of three; and two of these have perhaps four sides, and the others more or less. They perceive how defective this

is, and try to correct it, by patching it up with other pieces.

“ But the manner in which the bees adapt their houses to the situation they are at times forced to build in, is perhaps still more astonishing. They can give a gentle curve to the tubes of their cells, in the most masterly style of architecture, still preserving the utmost regularity in their rows. In order to be sparing of their wax, which, both in gathering and preparing, costs them much labour, they make the walls and bottoms of their cells thinner than the thinnest paper, so that it sometimes happens they are not strong enough to bear the weight of honey, or to resist the frequent pushes of the bees as they enter. The top of the cell, therefore, gives way first; but the bees take care to mend and guard it, by adding a string of wax around the entrance. And this, again, sometimes destroys its perfect hexagonal form.

“ Much time, and, we might easily fancy, much thought, are expended before the completion even of a single cell. If, in building it, the bee began it as thin as it ought to be, that part would probably burst by the force of her body pushing against it as she went on. She therefore makes it at first very thick, and afterwards, when she

begins to put the finishing stroke to it, cuts and pares away the walls to its proper delicate thinness, and makes use of the remaining wax to continue her work.

“ Here, as in every other part of their labours, they proceed with the utmost regularity ; one set of masons doing the rough work, while another set finish and polish it off.

“ But let us go through the whole process of their building, and observe how methodically they arrange their plans. The working bees are of two sorts—*nurse bees* and *wax makers*. The latter prepare their materials in the following curious manner :—they suspend themselves one to another, the claws of the fore legs of the undermost, clinging to those of the hind pair of the uppermost. Thus they cluster, and form a kind of curtain, consisting of continued festoons which cross each other in all directions : the backs of the bees only being in sight. Thus they remain without stirring for four-and-twenty hours, during which time the wax is forming beneath their bodies. One bee then moves to the top of the hive, and, taking the wax from its body with its hinder legs, conveys it to its mouth, and works it up ready for the masons to make use of.

“ The *foundress bee*, or the one who begins a

new comb, takes a little parcel of this prepared wax, and begins a wall. When she has placed the first heap, she flies away, and another takes her place ; and so on, till they have made a rough uneven wall, five or six inches long, fastened at one end to the top of the hive, and descending perpendicularly down the middle of it.

“ The nurse bees then take up the work, and polish and smooth what the wax makers have begun. The wax makers are therefore the labourers, who carry and place the stones ; the nurse bees, the masons who work them up into form. One of these masons places itself with its head close to the middle of this wall, which is to serve as a base for two sets of cells, and with its mandibles, moving its head about rapidly, forms the hollow for one of the cells. It then flies off, and another takes its place, and with its teeth and fore feet heaps up the wax on each side to begin the tube or cell. Twenty bees come one after another to this work.

“ When a little bit of each cell is completed, they go to the other side of the wall, and begin the cells there, working at two at a time. The wax makers continue to supply wax, and when one row of cells is quite finished, a new set of workmen polish and finish them off, while the

former set are busy at the cells on the other side.

“Thus regularly and orderly the bees go on, finishing one set of cells to a certain height before they begin another. It is with their antennæ that they measure their work as they go on ; this wonderful organ is so flexible that they can pass it over even the most delicate substance, so that, as well as serving them for compasses, it likewise enables them to go on with their work, even in the dark.

“It is at this work we shall now find them ; for at this most of them are employed the day through. Come, Miss Letitia, let us see now if we can make out what they are about.”

They all followed me eagerly to the hive, anxious to make their own observations.

“Ah !” cried Letitia, “here is one close to me ; she is planing the side of her house quite smooth.—See, see, how quickly she scrapes with her teeth ! Look at the tiny chips of wax she clears away !—She has stuck them together like a ball, about the size of a pin’s head. She has flown away, and carried the ball with her ! And, oh ! how curious ! Another bee has taken her place, and is going on with her work ! And she too has now flown away with her ball.”

“And now,” said I, “the best arithmetician of the party shall tell us how many cells there are in this comb.”

“If Miss Anne were but here!” they all exclaimed.

But presently they pulled forward a modest looking girl, with a singularly acute countenance, notwithstanding a slight cast in the eye, and declared that Elizabeth, for that was her name, was second only to Miss Anne, and was a capital arithmetician.

“I shall not put her skill to the proof so much as I wished you to believe,” said I smiling; for my sum is not a difficult one. This is it:—

“The comb contained in this hive is fifteen inches long and ten broad; and, the diameter of each cell being two lines and two-fifths, there are twenty cells in every four inches; that is to say, five cells in every inch.”

A slate was produced, and Elizabeth, with some hesitation, and some diffidence, came forward, and suggested that it would be first necessary to multiply the length and the breadth by each other,—that is to say, the 15 by 10; the produce of that, 150, giving the number of square inches contained in the comb. “As there are five cells in every inch,” continued she, “you must



multiply the 150 by 5. The produce of that, 750, must be multiplied by 2, because every comb, you said, was double. So that it makes the number of cells in this comb to be 1500."

Our little party was loud in its admiration of the ready manner in which Elizabeth had performed her task, which I assured her was quite correct; I then continued:—

"With regard to the depth of the cells, they vary; some being nearly half an inch in depth, others more, and others less. The deeper cells are turned into storehouses, if not wanted for the maggots: and when their honey harvest is so very plentiful, that they are in distress for room, they either lengthen out their old cells, or build others on a larger scale; so that the surface of the comb is never perfectly even."

"And do the queen bees," asked Letitia, "live in the same small kind of houses as their subjects, the working bees?"

"No," answered I; "how would that be consistent with the notions of the bees, of the respect due to their sovereign? But I shall be afraid of wearying you, if I go on with the subject at present. We will shut up the hive, and bid adieu to its industrious inhabitants; and, if Miss R. will allow, shew, for once, that we have not profited

by their example, but spend an idle evening in rowing down the river in my little boat."

Miss R. consenting, and the rest of the party making grateful speeches, I shewed them the way to the banks of the beautiful little river, at the bottom of the hill upon which my cottage was situated. We found the boat, in consequence of my previous directions, covered with a gay awning, and well stored with every thing necessary for tea, which I had resolved to make for my young friends in a beautiful dell a few miles down the river.

With a song from one, a joke from another, and a determination on the part of every one to please and be pleased, we passed the time most agreeably; and at a late hour, when the moon from her silver horns shed a faint and partial light, I took leave of them at the gate of their own house; and, slowly remounting the hill, returned to my cottage, to resume my usual habits and grave meditations.

## CHAPTER IV.

BUT adieu to "grave meditations."—"Put aside your book, my friend," said Wellingford; who, booted and spurred, but on foot, had stolen unperceived through my garden-gate.

"To the bee-hive let's away,  
In the merry month of May!

For yonder come your little pupils; and I too, meaning to have a peep to-day, have put my horse into your stable, and given my books a holiday."

The cheerful tone of his voice roused me from my studies; and who that passes his time alone from morn till night, has never felt the pleasure of such an interruption?

I bustled about to prepare for my visitors, though I affected all the time to look very solemn. "Wellingford," said I, "we will admit you of our party; but it is on condition only that you will be sedate in your conduct, and do not interrupt by your jokes the gravity of my lecture."

The young party, who had just entered the gate, assured me that it was in vain to expect such good conduct from Wellingford, and that I had better expel him at once. But Wellingford entreated, and I yielded to his desire.

“ Before I introduce you to the royal palace, I must give you some farther description of the city ; that is to say, of the honeycomb when completed.

“ You observe, that the combs all lie parallel to each other, so that a space is left between them, large enough for two bees to pass each other ; these I have called *streets*. Here, again, on the surface of the combs, are smaller openings, which serve as means of communication to the different parts of the hive.”

“ Then those are the alleys and courts, which you told us of, I suppose ?” said Letitia.

“ We may as well call them so. When the bees set about building a new city, after cleaning out the hive, which they do most carefully, they construct a few of the cells of the middle comb, as I have before fully explained to you ; then they begin two others, at some little distance ; and, by carrying on several buildings at once, set as many of their masons as possible to work at the same time. They divide into parties, and all keep

to their separate stations, without interfering with each other.

“ As they begin their building at the top, and proceed downwards, it appears, as it goes on, broad at the top and narrow at the bottom ; but when all is concluded, they bring the cells up level to each other ; and, to protect the opening of the cells, give to this part an additional coating of wax.

“ The space between the different combs, or as we may say, the streets, is invariably of the same width, four lines, which is the third of an inch ; and I must pause to admire the sense of the bees in this admirable construction. If the streets were wider, the bees would be too much dispersed, and too much cold air might penetrate into their city. If narrower, the bees could not pass freely, and the business of the hive would not go on so briskly. On the approach of winter, they are often obliged to lengthen their honey cells ; by which means they contract their streets, and make their habitations warmer. But, as during the winter they work little, and their stores are of the utmost importance to them, this puts them to no inconvenience ; and when spring returns, they take care to cut short their cells again, and widen their streets.

“ Having given you this general notion of the city, I will proceed, in a few minutes, to gratify your curiosity about the royal residences. The smallest set of cells you can see, are appropriated for the eggs of the workers, who, you remember, are the smallest bees. Some larger cells receive the males, or drones ; and a few others, very large, are set apart to receive the young queens, and are therefore called royal cells.

“ Queens !” cried Wellingford ; “ why, can your monarchy boast of *many* sovereigns, who all reign at the same time ?”

“ No,” said I ; “ they own obedience to one queen only. But, have patience ; and, when the proper time comes, all shall be explained to your satisfaction ; only believe, that what I tell you is perfectly true.”

“ Well, well !” said my impatient friend ; “ I will endeavour to be quiet : only it seems very extraordinary that there should be one queen only, and a number of royal cells to educate the young queens in. I suppose we shall have a battle by and by, and all be killed but one.”

“ There are other cells set apart to receive the honey in, and these are deeper than the rest.”

LETITIA. “ You have mentioned cells for the eggs of workers, and of drones, and royal cells ;

but surely you have missed the houses of the working bees themselves."

"Why, Letitia, these disinterested little beings are content to provide for the public good; they build only for their young and their stores; and they themselves lodge in the open streets and public places. Nor is every bee in a swarm provided with a separate cell to keep its food in: all are in common, and all are fed from the public storehouse.

"The queens only have private houses, or, as we ought to call them, palaces; and, in building these, some deviation from the general rule may again be observed. For instance, they are of a roundish oblong form. Look at this piece of comb; here are two royal cells upon it."

LETITIA. "They do not favour their queens much, then, if this round rough lump of wax is all they make for their palaces."

"In these edifices they seem to study solidity more than elegance, anxious to provide for the safety and real comfort of their beloved sovereign. They are, as you may observe, raised above the rest of the comb; and wax, of which they are so thrifty in their own habitations, is never spared in these buildings: the rough surface to which you object, is, in fact, a succession of cavities, formed

by little lumps of wax, which fortify and strengthen the outside of the palace. I had once the curiosity to weigh the royal cell, and found that it was equal to nearly a hundred common cells. And yet the one I took was not finished, nor was it quite so large as usual.

“They are equally prodigal, too, of their room : several smaller cells are sacrificed to serve as a foundation for a royal one, as well as a support to it. Sometimes, they fix it in the very centre of the comb, as you see here ; but it generally springs from the lower end of the comb. When but half built, it resembles an acorn cup, and is even sometimes fastened to the comb by a little stalk ; but, as they continue it, they lessen its width, and contract it, so as to make the lower narrower than the upper end. This lower end is left open at first : why and when they close it, I shall afterwards explain to you.”

LETITIA. “I suppose, then, that as they spare neither wax nor room for these royal palaces, we may conclude they leave the outside full of little holes, because they think it ornamental, since they could so easily plane it smooth, if they wished.”

“I think,” replied I, “that this is a very fair conclusion ; and now, having given you a very full account of the habitations, which the bees form for



themselves, let us vary the scene, by following the little things in their flights through the air, and see what is the daily occupation of these industrious workpeople. My own garden, which is richly supplied with flowers, affords employment to many 'hundreds of my little pensioners, who do not care to lose their time by ranging to great distances, if they can employ it more profitably near home."

WELLINGFORD. "But stop, my friend, you have built a city, and placed before our eyes an empty set of habitations: would it not be best to begin by telling us how these became stocked with inhabitants?"

"I think you are right, Wellingford; and, as I wish to confine your attention to this one hive, I must begin its history at least two months back. It then contained the remains of last year's population, plenty of workers, and one queen; a small, very small portion of empty comb; the honey I had left in having been nearly consumed for winter use. When the workers had finished a tolerable number of new cells, in the manner I have been describing, the queen-mother went from cell to cell depositing her eggs; and, as if she perfectly understood the nature of each egg, deposited each in the cell adapted to it. I have seen

her examine every cell attentively before she entered it, and quit it to search for another, if the first were not of the right kind. The eggs which are to produce workers are all laid first; and, so indefatigable is the queen-mother, that she allows herself no rest, but commonly lays two hundred eggs in a day, and if the weather be warm, a much greater number.

“ This occupies her about ten or twelve days, during which time the workers are busy building the larger cells. Before she fills these with male eggs, the queen increases so much in size, that she is hardly able to walk. For fifteen or twenty days, she is busy filling these cells; though their number is but as one to thirty, compared to those of the workers.

“ The royal cells are then put in hand by the workers, and the queen again lays workers' eggs. When the royal cells are completed, she deposits a single egg in each, and only one in two or three days; resuming her old occupation of filling the workers' cells in the intervals.

“ By the end of March, the cells are all built and occupied; and the old bees, no longer detained at home by their labours, or bad weather, prepare to sally forth in search of the various things they have need of. You, Letitia, probably think that

honey is the only thing the bees collect from flowers or plants?"

LETITIA. "Oh, I beg your pardon; have you not mentioned wax, of which their houses are built? I can assure you, I am very curious to hear where they get it from, and how they make it. I have often wished to know."

"Well, then, your curiosity shall soon be gratified, at least in due order; for I have learned from the bees, that arrangement and method are the best economy. The bees form honey and wax from the nectar of flowers; and, perhaps, since I have found such skilful geometricians and arithmeticians in the party, there may be one of my friends who can inform me from what part of the flower this nectar, or honey, is got."

Letitia and Elizabeth both smiled at the compliment paid them; while Harriet, a fair blooming girl, simply said, "She believed, honey was found in the nectaries of flowers, which were generally long narrow tubes, in the centre of the blossom; though the situation varied in almost every different flower."

"Your account is very right: botanists were long before they became acquainted with this natural reservoir of honey, but bees have ever known it; and, hidden as it is, are able, with their long

tongues, to suck up the fluid from its deep well. This organ, which formerly was supposed to be a pump for sucking up the honey within it, is now discovered to be nothing but a tongue, which licks up the honey, and passes it onwards, upon its surface, to the mouth, which is concealed by the mandibles at its lower extremity.

“ Follow me gently out of the arbour into my garden ; here is a bee just alighted on this jasmine bush. Hark ! that hum is caused by the motion of its wings ; the hum ceases ; the long tongue is unrolled from under its head ; it is darted with the rapidity of lightning between the white leaves, or petals, of the flowers, and the stamens, or little coloured stalks, in the centre of it. You must approach one at a time, for it requires very close observation. See how she throws out her tongue, then contracts it : how swiftly she moves it up and down, and lets not an atom of the delicious juice escape her.”

WELLINGFORD. “ I perceive plainly, that it licks the honey into its mouth. Now pray, let us hear how this honey gets home to the young, if the bees swallow it up as fast as they get it ?”

“ You may well be inclined to be incredulous, Wellingford, for it is a very curious fact. You have, however, yourself witnessed how they take

the honey ; if we return to the hive, you may see them deposit it in their storehouses."

Wellington assured me, he believed what I had told him ; but as he wished to watch the bees in the open air a little longer, he thought we might defer our visit to the hive for a few minutes.

" Well then," said I, " you have observed the bee which sucked in the honey from the jasmine, has flown from one flower to another, and appears to succeed in getting fresh liquid sweets from all. It has been disputed among the friends of the bees, whether each bee does not confine itself to one particular kind of flower ; but it seems now generally believed that they do, what we have certainly seen this do, take the nectar of most flowers within their reach."

LETITIA. " Is there honey then in every flower that grows?"

" Whether there is or not," said I, " the bees fly from some, and from others seem unable to extract honey : this is the case with the trumpet honeysuckle, which they never touch ; although, when burst open, it lets out a drop or two of pure nectar."

LETITIA. " Then I should give this as another instance of the economy of the bees : that, as they are not sure of succeeding, they will not waste

their time by making vain attempts at this flower. But why do they fly from any ?”

“ Because their instinct warns them that the nectar contained in such, is of a poisonous quality. This is the case with that noble flower, the crown imperial, whose white nectaries, so ornamental, appear like wells of clear honey within the flower leaf. The bee takes no notice of this tempting sight ; but passes by, without being for a moment diverted from his course.

“ The oleander abounds in honey ; and flies, less wary or less sagacious than bees, are killed by thousands, as they suck in the sweet poison. Bees never taste it. When it is a poor flower season, however, bees seem to lose this instinct, in their ardent desire to procure provender ; and many consequently perish. Instances have been known of whole swarms being destroyed, merely by alighting upon poisonous trees. I remember hearing of a swarm, in New York, which, after passing a night upon a poison-ash, were found dead the next morning, with their bodies swollen to an enormous size.”

MISS R. “ From this account, it appears that some honey is poisonous to the bees themselves ; is there not also some which, when collected by the bees, is poisonous to man ? I have heard that

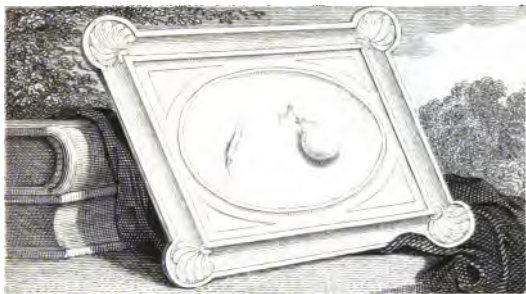
the honey extracted from the beautiful American plant, the *kalmia*, for instance, is poisonous. Is this true?"

"I believe so ; and, about thirty years since, so great a number of people died in the neighbourhood of Philadelphia, that the government made inquiries into the cause, and found that most of the people had been eating honey collected by the bees chiefly from that species of plants."

LETITIA. "I remember, in the account of the retreat of the Greeks, after the death of Cyrus, that they met with a kind of honey, on the shores of the Black Sea, which affected the soldiers in a very curious manner. Those who ate but little seemed as if very drunk, while those who partook more plentifully of it, seemed either mad or in a dying state ; numbers lying down on the ground, as if just defeated in battle."

"This kind of honey," said I, "is mentioned by Pliny, the first great naturalist ; and was said by him to have been extracted from a beautiful plant, the *rhododendron*, whose fine lilac flowers I observed in your shrubbery the other day ; and highly ornamental it is : but, please to remark, that in my garden, I allow neither the *kalmia* nor the *rhododendron* to shew their heads. I rather follow the advice of the poet ; and,

4.



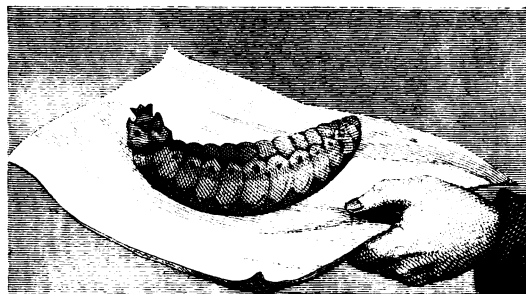
*Page 63.*

5.



*Page 73.*

6.



*Page 78.*





Wild thyme and sav'ry set around their cell;  
Sweet to the taste, and fragrant to the smell;  
Set rows of rosemary with flowering stem,  
And let thy purple violets drink the stream.

“And now, I must explain to you the process the nectar undergoes before it becomes, properly speaking, honey. Every bee is provided with two stomachs; on this paper, you will see a rough drawing I have made, in order to give an idea of the form of this part of a bee's body. It is, of course, much larger than life, having been drawn from a microscopic view. This bag, which looks like an indian-rubber bottle, is the first stomach, and the narrow part of it is called the neck of the stomach, or *œsophagus*. When empty, this stomach looks like a thin thread: when full, like a tiny white bladder. Into this first stomach goes all the honey which the bee collects with his tongue, and which, small as it is, it takes a long time, and the nectar from many, many flowers, to fill.

“This examination is enough for our present purpose; we will study the other stomach when we learn how wax is collected. Now, Wellingford, your curiosity shall be pained no longer; we will follow these loaded bees to the hive, and through its windows see what they do with the treasure they have just collected.”

Wellington declared that he could see the little things within the hive; but that they were so many, and made so great a bustle, he could not say positively what they were doing.

“Some,” said I, “disgorge the honey, which, after passing through their stomach has become a thicker fluid, into the empty cells destined to be storehouses. If the cells are already half filled, they are covered with a kind of cream, which always rises at the top, and prevents the honey from running out of the combs; which, as I have before told you, are placed horizontally in the hive. Cannot you perceive a bee busy with her mandibles, boring a small hole through this cream? And cannot you now see her, head foremost, disgorge her honey into the cell, and fill it up? She has still some left, and goes to the next cell, which she likewise opens and fills up. The cells that are thus entirely filled up, are intended for storehouses, and will presently be sealed up by a waxen lid.”

LETITIA. “I cannot conceive the use of this waxen lid, if the cream itself would prevent the honey from escaping from the cell.”

“I will tell you the reason; for, without one, we may be sure the bees would not waste their wax in making a cover. Food of all kind, if kept

long, must be shut up ; and honey in particular, if exposed to the air, becomes rough and thick. As the honey deposited in these cells is intended for use all through the winter, it is very necessary to pay the greatest attention to its preservation, the heat of the hive itself keeping it constantly fluid ; and by hermetically sealing up the cell, it remains in as fresh and clear a state as when first put in."

LETITIA. " I see the whole thing very clearly, for here is a bee come to a cell close to the window. I see her put her two mandibles and make a small hole in the cream, then thrust her head in and empty the honey from her mouth ; now she is carefully making up again the hole in the cream. How neatly she does her work, and how beautifully clear does the honey look through the transparent tubes !"

Pleased at the delight she took in making her own observations, I let her go on without interruption.

" See ! see !" she cried. " Some of the bees who come in seem to be feeding the others with their newly gained honey. There seem to be cells with young ones in !"

" Stop, Letitia," cried Elizabeth, the clever accountant, who liked to have a clear notion of

every thing ; “ do not go on to another subject yet ; for I want to know more things about honey. And first of all, pray Miss R. do explain to me the meaning of being *hermetically* sealed.”

MISS R. “ It means *chemically* ; or in such a manner as chemists would seal up their most precious fluids, to prevent the slightest particle of air from getting in. I observed in the piece of dried comb, that the flat waxen lid which covered up the store cells of the bees, is of thicker wax than the sides, and fitted to the cell with the greatest nicety.”

“ Their waxen lids are formed thus,” said I : “ within the edge of the cell, they first make a circle, or ring of wax ; to this they add another ring ; and then another within that. In fact, they go on making ring within ring, till the lid is completed.

“ I hope,” continued I, “ that you all admire the pattern, set by my little friends, of prudence and foresight, in laying up stores from their time of abundance. You will be almost equally surprised to hear that the bees of my hives do not confine themselves to the honey they can collect from the flowers of my garden : they do not reason thus, as many an indolent person does, ‘ Whatever is within my reach, I will get ; and whatever

is easy to be done, I will do;' but they fly for a mile round in search of their stores; they try every garden, and omit no flower that can yield them nectar."

LETITIA. "How do they find out the flowers that contain honey?"

"By their scent," replied I, "which is remarkably acute. Insects are not provided with a pair of ears, like ours; and naturalists have been puzzled to find out where these organs were situated in bees. Some have believed them to be in the little holes in the sides for emitting air, while others have declared they were in the antennæ. Huber, the celebrated naturalist of Geneva, whom I have before mentioned, has discovered them to be in the mouth, for he stopped the mouths of several with paste and set them at liberty; after which he found that they were insensible of every odour.

"I have told you that bees fly a mile in search of honey, which by their acute scent they find in flowers where it lies deeply hid; when their honey-bags or stomachs are full, they fly home again in a direct line; and, I must own, this part of their economy of time and labour, seems to me one of their most astonishing instincts."

LETITIA. "It is indeed very curious. I should have fancied them groping about in search of their

distant habitations, and often getting to a wrong home at last. But there is one question, I wish to ask : honey, you have told me, feeds the bees : but is it of much use to us, after all our pains in collecting it ?”

“Honey is chiefly used for its medicinal properties at this time ; but formerly, among the ancients, it was reckoned almost divine food : they called it, in fact, a ‘ gift of the gods.’ It served them for sugar, which was unknown in those days ; and they considered it a remedy for every complaint. Pythagoras and Democritus, and many other sages, lived chiefly on bread and honey, from an idea that the use of it would lengthen their lives, and keep their minds vigorous.”

Whether my young friends began to be afraid, that, having introduced the names of two philosophers, I should be getting too deep or too dull for them, I could not guess, but I saw a general movement among the party ; and even Wellingford had jumped up from the arbour bench on which he had been lolling,—listening, however, to my discourse with marvellous patience. “I hope you will allow us to come again,” said Letitia ; “ for, after all I have heard about honey, I am not satisfied until I see more of the young bees in the cells, and hear how they are brought up and edu-

cated, and when they will begin to fly and provide for themselves as the others do."

I gladly repeated my general invitation to the party, to come whenever they had nothing better to do ; for I found that the more I told, the more I had to tell ; and, having gone so far into the subject, I felt as eager to impart as they were to learn.

"Good night," said I. "Willing hearers make happy teachers." And I stood with my arms crossed over the wicket of my garden, until the whole group had descended the circuitous path down the hill, and passed the cottage belonging to the blacksmith's forge, which was the boundary between their parish and my own.

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## CHAPTER V.

MORE than ever interested in the subject, my little party did not suffer many days to elapse before they again assembled in my garden.

"Your anxiety, Letitia," said I, "to know how young bees get on, cannot yet be gratified ; for, while the weather is fine, we had better observe what other duties the bees have in the open air,



besides that of collecting honey. This, though its first object when perched upon a flower, is not its only one; for, after it has filled its honey-bag with the sweet nectar, it continues its collections, and by means of the delicate and feathery hairs by which its body is covered, collects a quantity of pollen, or dust of the anthers, which are those little round knobs on the top of the fine threads in the centre of every flower. Observe, for instance, this white lily, which, if you smell, will leave its yellow dust upon your face. This is pollen, and is as necessary to the society within the hive as honey itself. We need not go far in search of a proof of what I have been telling you; for, see, a bee has perched upon this very flower, and has already ransacked its nectary."

LETITIA. "Its body is also covered with its yellow dust; but what is it now about?"

"It is brushing it off with the tufts of hair, or brushes, of its legs; not to throw it away, but to collect all together, and knead it into two little balls. These she places within a hollow space at the bottom of her hinder legs, and they are prevented from falling out by a small tuft of hair; these hollow spaces are called her baskets.

"In wet weather, they cannot so easily get rid of the pollen from their bodies; they therefore re-

turn to the hive dusted all over with it, and there brush it off with their feet. When the anther of the flower is not burst, the bee will open it with its mandibles, and with its fore legs take out some pollen, which she passes to the middle pair of legs, and thence to the hinder pair, where it is safely deposited in the baskets.

“Now, I must tell you, it has long been a disputed point, whether or not the bee, in collecting the pollen, confines herself to one kind of plants, or gets it first from one and then another, indiscriminately. One thing is certain, and we shall soon see this fact, that when they return laden to the hive, some have their little balls, or pellets, of one colour, some of another, and in damp weather I have seen one bee with its body all orange, another yellow, and another white. This makes it appear plain enough to me that, at all events, a bee confines itself to those flowers whose pollens are of the same colour, and I think it most probable, to those of one kind also.

“To give you some idea of what may be done by each individual contributing its mite, I must tell you, that in a plentiful flower season, like the present, the bees of one single hive, will, in the course of one day, bring home a pound, or more, of this pollen.”

LETITIA. "I can scarcely give credit to this account, when I see the very, very tiny balls that each bee brings home after her flight."

"You must not forget that each bee will make a number of these small collections in the course of one day ; and that the hive contains probably between twenty and thirty thousand workers, all equally zealous and indefatigable. During the whole of the last month and the present, they have collected all day long ; when the weather is hotter, and their labours farther advanced, they will confine their labours to the morning, leaving the hive, as I have frequently seen them do, at four o'clock in the morning, and returning with their baskets full about eleven."

LETITIA. "You have not yet explained the use the bees make of this pollen."

"No ; but I will tell you now. It is of great importance to them, for it forms their bread, *bee-bread*, or *sandarach*, as it is called ; and, while honey is the dainty fare with which they regale their queens, the males during their short life, and in part their young ; this bee-bread is the substantial food of the community. We have watched the bees stealing from flowers, nectar, or the contents of the nectaries, from which they make honey and wax ; and pollen, which forms their

bee-bread. Besides these two substances, there is a third, a kind of glue or gummy matter, called *propolis*, or *virgin wax*, used by the bees to cement and finish their combs.

“You must not suppose that all this information I am giving you, has been gleaned by my own observations. Naturalists have been engaged for years and years, without being able to settle the reality of a single fact. It was quite accidentally even that Huber, after being long puzzled, discovered from what tree this gummy matter was procured. After trying various experiments, he planted a number of cuttings of a kind of poplar, whose leaves, before they quite unfold, are filled and covered with a glutinous kind of juice. These he placed in pots just before the hive, and presently he saw a bee perch upon a twig, open a bud with its mandibles, and suck up the gluten : with its second legs, it took it from its mouth, and, so passing it on to its baskets, conveyed it home.

“Since this discovery, I have myself seen my bees collecting it from the *tacahamahaca*; that shrub, which you may know by the unpleasant smell of its leaves, resembling rhubarb. It is likewise found in the willow and birch. This gummy stuff, called *propolis*, is soft and red, and will pull out in a thread : it is very fragrant ; and,

if put upon white metals, such as silver or tin, gives them a golden colour."

LETITIA. "I have not forgotten what you told us about the use of this propolis, in stopping up holes, and defending the weak places in the hive. Do they procure it from nothing but these trees?"

"It is possible to make them use an artificial propolis; for instance, I once mixed up some turpentine and bees' wax, and put it over the decayed part of a tree, near the hive. The bees soon attacked it, and I was amused to observe that, in their eagerness, one bee frequently came behind another, just as it was laden, and robbed it of all it had collected. I have seen one bee lose a second and third load in the same manner, and patiently return to the tree to collect again.

"But to judge of their patience, you should watch as I have done, and see the difficulty of getting at this rosin. You should see them tug and tug, till at last a little morsel gives way and becomes pliable. The bee loads herself with it; and places an enormous ball on each leg. It takes her at least half an hour to do all this, to pull it with her teeth, and work it up with her fore-legs, to knock it about with her pallet, and pass it from leg to leg, till she gets it into her basket.

"These are the three substances collected by

the bees : I have told you, that from the first of these, nectar, she forms her honey and wax ; and I have shewn you the process the honey goes through before she deposits it in the comb. Shall I now explain to you how so harsh and insipid a substance as wax, is formed from the same sweet material ; or are you wearied with the long and patient attention you have been kind enough to give me ?”

Miss R. answered for her young friends, that far from being tired, they had had their curiosity much gratified, and they were anxious to become thoroughly acquainted with a subject so worthy of their study. “ But,” said she, “ allow me to ask you one question. You say that wax, as well as honey, is made from the nectar of plants : surely you are mistaken ; I thought that wax was made from the pollen, or dust of the stamens ?”

“ It was thought so until lately ; but it is now known that wax is made from honey. You remember, I told you that the bee had two stomachs ; and I shewed you a picture of the first stomach, which holds the honey, which they afterwards deposit in their hive.

“ The second stomach resembles a longish cask, covered with hoops from beginning to end ; this never contains honey, but only bee-bread ; but

underneath it are a number of little pockets, of a soft and whitish substance, which are called *wax pockets*. A part of the honey contained in the honey bag, becomes converted into wax. It makes its appearance underneath these pockets, in the form of little scales, which the bees can take away from their bodies as they want it, or get their fellow-labourers to help them, as I have before explained in the making of the combs. Most of the wax used in Europe is the produce of our hive-bees; in America, there are wild bees, from which it is collected.

“ Having thus followed the bee in her labours out of doors, let us now see what use she makes of her stores when she gets home.”

“ Oh !” cried Letitia, “ this is what I have been most anxious to do ;” and she pressed forward eagerly to the window of the glass-hive. “ But, do tell me what that cluster of bees is about : they seem hanging all together, just at the top.”

“ Those,” said I, “ are the very bees we have been talking about—the wax gatherers. These bees are just come in from a laborious flight ; and, having filled their own honey bags, and given some to their companions, will hang together in that cluster for some time. It is now

that the honey they have collected is going through the process that converts it into wax. Wait a few minutes, and tell me what you observe."

Letitia, after a few minutes' close attention, declared that she could fancy she saw other bees coming and seizing upon something from the bodies of their clustered brethren.

"I expected as much," said I; "the bees are so eager to get some materials for continuing their buildings, that they are not very attentive to the rights of justice, and are actually seizing upon the little scales of wax as soon as they are formed.

"Having already shewn you how they use this wax, when thus prepared, we will find out what the other class of workers is about."

LETITIA. "You mean the nurses? They are to feed the young, you know; but I see no young bees at all in the hive."

"What do you see, then, at the bottom of the cells?" asked I.

"In the first place," said Letitia, "the inside of the hive is quite altered; it is almost entirely filled up with comb; and, instead of the little egg, I observe at the bottom of the few that are just opposite to me, a whitish lump."

"The insects have gone through their first me-



tamorphosis, Letitia, and are become—do you remember what?”

As Letitia seemed to be recollecting herself, Sarah, the youngest of the party, stepped forward, and said she remembered very well that they were called *larvæ* in their second state.

With a smile of approbation for her good memory, I went to fetch a little specimen I had dried of the insect during this state of its existence.

“The larva, or maggot of the bee, is long; and, when partly grown, rolls itself up in a ring, with its head upon its back. Here is a full-grown one, and it resembles the large white worm met with in the rotten trunks of trees. It has no feet; and, if brought out of its cell, looks starved, and moves feebly about. In fact, it is rather like a silkworm, having an upper and under lip, as well as two scaly teeth, which cover the mouth when it is closed.”

“And are those tiny white and shining globes its eyes?” asked Letitia.

“Yes,” said I; “and beneath its mouth, though you cannot perceive it, is placed a spinning bag, something like that with which silkworms are provided, and with which they begin to spin their pretty little balls of silk.”

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LETITIA. "What ! do bees spin silk, like silk-worms ?"

"You shall hear by and by," said I ; "at present, we must see how this larva, or maggot, subsists at the bottom of its cell. Now, whose office is it to bring them their food ?"

LETITIA. "The nursing bees, you know ; and I think I can see some, popping their heads down into the cells of the larvæ. Is this the way they feed them ?"

"Yes. This is their occupation at the present moment. They return laden with honey and pollen ; and with this and a portion of water, they form a kind of jelly, which they throw from their mouths into these cells, making for the young a kind of bed of food ; so that they have only to turn their heads and eat, whenever they have a mind.

"It is impossible for any tender mother, or nurse, to be more attentive to their little ones than these nursing bees."

"I think," said Sarah, "that I can see a proof of this, if I am not mistaken. I have been watching a cell just close to the window, which a nurse has been supplying with jelly. Since she went away, I have seen several, one after the other, just pop their heads in, as if they were

looking to see if the helpless young one wanted any thing. They seem satisfied with a single glance, and pass on to another and another, till they find one that needs food."

"Well done, my little friend," said I; "you will be one of our cleverest bee students; for you have entered into their thoughts exactly."

"While the larvæ are very young, the jelly which they are thus supplied with is of a whitish colour, and has very little taste; as they grow older it becomes more transparent, like jelly, of a yellow colour, and has rather more flavour."

LETITIA. "You seem to know how their food tastes: have you ever eaten any of it?"

"I own, I have had the curiosity to taste it several times; but you will think nothing of this, when I tell you, that Swammerdam, a famous naturalist, had the curiosity to eat one of the maggots, to discover what taste it had!"

"And what did it taste like?" asked Letitia.

"It was very disagreeable, and tasted like rancid bacon; but, surely, before you shudder so at the thought, you ought to remember how grateful we ought to be to that man who first had curiosity enough to swallow an oyster."

"These watchful nurses supply the young larvæ several times every day, and are rewarded

by seeing them grow rapidly. In five or six days, the maggot is full grown ; and when the nurses perceive this, they leave off bringing them food, their instinct teaching them that it would be useless in the state to which they are approaching.

“ The change from the larva, or maggot, into the pupa, or chrysalis state, is one of the most dangerous and difficult operations in the life of an insect.

“ The nurses have still one duty to perform, which they never forget ; and this is, to stop the entrance of the cell with wax, in order that the insect may neither be exposed to the open air, nor troubled with visits. They then leave her to herself ; and the first thing she does is to spin a web of silk, with which she lines the inside of her cell.”

SARAH. “ I cannot at all guess why she should give herself the trouble of doing that. Is it to adorn her cell ?”

“ A bee is too economical of her time and materials, to waste them in merely decorating her apartments. I can give you a more satisfactory explanation of her actions.

“ Her instinct teaches her, that her body is about to become more tender ; and, as all the jelly which served as bed and food is exhausted, she

takes this means of lining her house, and of preventing the corners of it from hurting her.

“ Nature, who gave her the instinct, has provided her too with a spinning bag, and some silky matter, as a means of guarding herself against this inconvenience.

“ The silken thread spun by the pupa, is as fine and close as possible, and clings to the waxen walls of the house; and, what is very singular, is not taken away when the pupa has burst through its cell and become a perfect bee, although the cell is then cleaned out for the reception of fresh larvæ, by the industrious workpeople of the hive.

“ As the shades of evening are coming on, we must leave these insects to their repose; and, probably, before you come again, the second metamorphosis may have taken place, and the larvæ you now see so busily eating, may be enclosed within their silken web.”

As it was too late for the party to prolong their walk, I put in a claim upon them, to take bachelor's fare with me at the tea-table; with a promise on my part to escort them home in the evening.

We entered my cottage, and the young party were much amused by my peculiar style of mak-

7



*Page 82.*

8



*Page 95.*

9



*Page 109.*



ing tea; for my politeness would not allow of any of my visitors presiding.

Amidst our merriment, we did not omit to quiz Sarah on the great penetration she had shewn about the bees; and I accused her of having hunted into books and studied the subject, to make herself appear wiser than the others. Sarah was more diverted than any of the party at this attack upon her; and declared she should avenge herself, by making me shew them the dead insects, which were shut up in my cabinets.

I was rather glad of this hint, as it afforded me the means of amusing them for the remainder of the evening; and I allowed them free liberty to ransack my shelves.

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## CHAPTER VI.

AS I was now becoming very intimate with my new acquaintance, and had got over some of my shyness on facing so many females, I walked over to the school, one very fine afternoon, to fetch them to look at a comb full of pupæ, which I had just discovered within my hive. It happened, fortunately, to be a half holiday; and, as I heard



the buzz of voices in the garden behind the house, I directed my steps thither, through a dark shrubby walk.

I was unobserved, therefore, by the little girls before I reached them, and overheard, without intending it, some of the conversation they were holding together, while twining the raspberry bushes, which they had just gained permission to transplant from the larger beds.

The voice of Sarah was loudest, for she was recapitulating, with great animation, all that she had heard the last time she had been at Long Hampton. I just came upon them as they were crying out,—“ O that we had a glass hive in our stone arbour, at the bottom of the garden !”

They all came running up to me, when they saw me; and after a good laugh at little Sarah turning lecturer instead of me, I told them my errand, and bid them run to the house, and gain permission to accompany me home.

I followed them, and, entering the parlour, soon prevailed on Miss R. to form our usual party, and hasten to my arbour. “ For,” said I, “ the season is advancing, and we should not delay our observations.”

We were again soon stationed around the glass hive in my arbour, each of its windows having

two or three heads eagerly peeping through it. I waited till some one should make an observation on the state of the combs.

Letitia was the first to break silence: "I have found," said she, "the bit of comb, which I saw last time, when every cell was filled with larvæ; I see now they are all closed up, and, therefore, I suppose, they are changed into pupæ. I can see nothing of what they are about, I suppose."

"Look," said I, "I have taken a piece out of the hive, and cut the tops off the cells. You may now see what they contain. It has spun its silk, thrown off the skin of a maggot, and is clothed in one of a much finer kind. It is still white. By and by, its eyes will look red, and its body will be covered with greyish hairs.

"By degrees, beneath its delicate veil, it assumes the form of a perfect bee; in another fortnight, it will bite its way out of its covering and cell, and start into the world a full grown and perfect bee.

"To this state, she is, however, not yet arrived. We will leave her shut up in her cell, at her solitary labours, and see what the other members of the hive are about."

LETITIA. "I think you have forgotten the queen; I have been looking about for her, hoping

to see a royal personage followed by her train in great state; but I have not yet found her out. Perhaps she is not at home. Does she live most within the hive, or out of doors?"

"I may appear to have neglected her majesty; but it was only that I might be methodical in my account. I shall soon do her full justice.

"We have followed the workers through their several changes, from the time when the queen left the egg in the cell. These occupy about twenty days of the life of a worker, and as many as twenty-four of that of a drone.

"The manner of rearing a queen bee is very similar to that which I have been relating of the working bees. The eggs laid in a royal cell, are exactly the same in form and size as those of the workers; but they are fed with a kind of food, called *royal jelly*, which is less insipid than that given to the workers. It is pungent and stimulating, and the nurses are unwearied in their care to keep the cells constantly supplied with it. So abundantly do they provide it, that the royal little ones are unable to consume it all, and there is generally some left at the bottom of the cells which the queens leave.

"In consequence of this rich fare, a queen becomes full grown sooner than a working bee. In

five days, it prepares to weave its web. This silken coating, or *cocoon*, as it is called, is different from the others, in not forming a complete covering for the body; the head and throat, with part of the stomach, only being concealed by it. It is completed in twenty-four hours; and in two days and a half more, it changes into the pupa, or chrysalis state. Four or five days more are sufficient for the perfection of its limbs; so that in sixteen days from its birth, the full grown queen is prepared to step forth into the world.

“But who would envy the fate of this newborn monarch, whose very entrance into life is marked with care and sorrow?”

LETITIA. “How can that be; since you have told us that the queen is so beloved by her subjects, that they are ever anxious to shew their respect and affection: that she is allowed to take no part in the labours of the hive, but is fed from the choicest gleanings of the labourers?”

SARAH. “Even that does not surprise me so much, as to hear that royal cells are built, and queens reared, in a hive already supplied with one; because you told us that never more than one queen was suffered to reign in a hive.”

“I will satisfy all your doubts,” said I; “and shall begin with those of Sarah, because that will

partly explain the cause of Letitia's surprise. My hive, as you may observe, is, even in this early season, tolerably full of inhabitants. By the time the eggs already laid are all hatched, and the larvæ and pupæ become bees, it will be overstocked; a number of them will then collect together, and fly off to some neighbouring tree or garden, where they will be caught and put into another hive.

“This is called *swarming*; and every swarm requires a queen bee to lead the flight. I shall give you a fuller account of swarming some other time, but this will explain to you why it is necessary to rear new queens, whose lives and preservation are as essential to the colony as those of the old ones.

“And this, too, will lead to an explanation of the strife and sorrow prepared for the young queen, when she is ready to burst from her cell. While the old queen is still in the hive, waiting till the weather will allow her to lead out a swarm, the working bees, who, like ministers of state, conduct all public business, will not suffer the young queens to leave their cells. A band of guards surround them, and put an extra coating of wax on the top. In this they bore a hole, through which the royal prisoner stretches its trunk to receive its daily supply of food.

While thus confined, she utters a plaintive kind of song."

LETITIA. "I do think she is to be pitied, if her own subjects begin by persecuting her."

"Not so," answered I; "they only wish to protect her from the fury of the old queen, whose jealousy is such, that she will permit no rival queens to share her honours; and her hatred of them is so great, that nothing short of their destruction will satisfy her."

"It is for this reason, that the bees take upon themselves the office of guards, to keep off the approaches of the old queen. In their zeal, they even seem to forget their duty to her, and may be seen beating her away, if she attempts to come near."

"This takes place whenever there is a prospect of a speedy swarm; but, alas! for the new queens, if swarming season be over, or the weather unfavourable! They are, in such cases, deserted by their guards, and the old queen has full liberty to gratify her anger against her innocent victims."

"She darts with fury upon the first royal cell she meets with: with her jaws, she bites through its waxen lid, pushes her back into the hole, and stings the poor defenceless bee to death."

"As this seems an order of nature, it is sup-

posed that the royal cocoons are left in the imperfect state I have before described, in order that the old queen may be able to introduce her sting.

“As soon as this sad act is finished, the workers, who had been standing quietly by, enlarge the hole, and drag out the dead body.

“The old queen passes on to all the other royal cells, and if she finds the bee in the pupa state only, her rage is not so great; she tears open the cell, but does not thrust her sting into it. Its death, however, is equally certain; for the workers pull it out, after the hole has been made, and leave it to perish.

“Last year, the old queen of my glass hive had been killed just as the young ones were prepared to enter the imago state. I was curious to observe the actions of the first who should escape from her cell, and actually witnessed the very scene I have been describing to you.

“Not more than ten minutes had elapsed, before she was seized with all the fury of jealousy, and the five or six royal cells contained within my hive were all torn open and despoiled, one after the other.”

SARAH. “This, surely, must be the most melancholy part of the history of bees?”

“You must prepare some more pity,” said I;

“ for I have much still to relate of the combats of the queens. I wish you could yourselves witness them, but the queen is not often visible, and it is only from the patient observations of many and many a year, that I have become acquainted with all I am telling you.

“ Many years ago, when the population of my hive was in a very thin state, I saw two young queens emerge from their cells at the same moment. As soon as they perceived each other, they rushed furiously forward, until the jaws of each grasped the antennæ of the other. Their heads, their trunks, and stomachs, were mutually opposed ; they had only to curve their tails and sting each other, and both would have fallen down dead together. To my surprise, at this very moment they parted, and fled from each other as if seized with the greatest fear. In a few minutes, they seemed to have recovered from this panic, and returned to the attack. They again met, just in the same position, and as hastily fled away.

“ The workers, all this time, were standing about in great agitation, which increased whenever the queens separated. Twice I observed them stop their flight, and hold them prisoners for more than a minute. At length the queen, who was either the strongest or the most furious, darted



on her rival when she was not prepared, caught her by the wing, and stung her: then, letting go her wing, she withdrew her sting.

“The vanquished queen fell down, dragged herself feebly along; her strength soon failed her, and she expired.

“I see you look very woe-begone, Letitia, and think me perhaps very hard-hearted in telling you a tale of so much cruelty! But summon your fortitude; I have more to tell you still.”

LETITIA. “My curiosity to know more of these wonderful little beings, is, I fear, still greater than my compassion for their sufferings. But pray explain, before you go on, the anecdote you have just been telling us. I cannot understand why the two bees ran away from each other just as their battle might have been ended!”

“There can be,” said I, “but a single queen reigning in every hive. When a new one is added, therefore, one must perish; but if both were destroyed, the hive would be left destitute of any queen at all, which would be equally contrary to the law of nature.”

SARAH. “It is instinct, then, which teaches these rival queens that it would be contrary to the interests of the state that both should die; and

which makes them retreat at the moment that such is likely to be the case."

"Exactly so. You shall now hear of an experiment I made, not long ago, which gave me still greater reason to admire the plan and design which seem to govern all the actions of these insects.

"I painted the throat of a queen, in order that I might be able to distinguish her, and introduced her into a hive already provided with one.

"Instantly, I saw my bee surrounded by a band of workers; who advanced towards her, but not to caress and receive her kindly, as they would have done if she had been their true and lawful sovereign. They crowded round her so closely, that in less than a minute she was deprived of liberty, and became their prisoner.

"I was still more surprised, in observing that another set of workers had crowded round and detained their own queen; and, as I soon perceived, not in order to prevent her from fighting, but from an anxiety to witness the combat which they knew must take place.

"As soon as the right queen shewed signs of wishing to attack her rival, both clusters of bees

gave way, and disappearing by degrees, left an open space between the combs for the battle.

“As soon as the two queens were near enough to see each other, the rightful queen rushed furiously upon the pretender; seized her with her jaws, and, fixing her to the comb, quickly despatched her with her ever-ready weapon, the sting.”

SARAH. “I wonder that the workers, who, as you say, can act either as ministers of state or soldiers, and whom you represented as so loyal,—I wonder that they should not unite to defend their beloved sovereign, rather than suffer her thus to expose her person to danger.”

“Your observation, Sarah, shews great reflection. It is a subject which has puzzled every naturalist, who, like myself, has observed the fact over and over again, without being able to account for this apparent inconsistency in the conduct of the working bees.

“But my lecture has, I think, been long enough for one afternoon; I fetched you here, and I must take you back, before you become quite melancholy, or grave.—What say you to another row down the river?—If you are courageous enough to venture to the Castle mill, follow me. I have got permission to take you home through

the park; and shall send my old dame to the lodge, to prepare tea for us."

Joy gladdened the countenances of my little bee students; and we were quickly equipped and seated in my boat, which cut gaily through the waters. Mirth succeeded to our sedate conversations, and we made the shores resound with our laughter and singing.

The old grey walls of the castle soon greeted us; at the romantic mill-dam at the end of the rock beneath them, we landed, and started up the long avenues which lead to the castle lodge. Our walk was frequently suspended, that we might listen to the notes of the nightingales, who make these woods their favourite haunts; and we listened with the greater eagerness, as we had reason to expect they would shortly desert us.

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## CHAPTER VII.

"You have told us," cried Letitia, the next time I was favoured by a visit from my young friends, "of the various quarrels of the queens; now I wish very much to know, what would happen if a hive were left entirely without a queen?"

Would the bees mourn her loss? or would they go about hunting for another?"

"I must explain the secret of Letitia's curiosity on this subject," said Miss R.; "by telling you that we have been reading what Virgil says in his *Georgic* about bees. I think, Letitia, you learnt that passage relating to the affection of the subjects for their queen; or, as Virgil calls it, their king."

When I begged to hear it, Letitia very pleasingly complied, and repeated the following lines:—

"Besides, not Egypt, India, Media, more  
With servile awe their idol king adore;  
While he survives, in concord and content  
The commons live, by no divisions rent;  
But the great monarch's death dissolves the government.  
All goes to ruin, they themselves contrive  
To rob the honey, and subvert the hive.  
The king presides, his subjects' toil surveys,  
The servile rout their careful Cæsar praise:  
Him they extol, they worship him alone,  
They crowd his levees, and support his throne:  
They raise him on their shoulders with a shout;  
And when their sov'reign's quarrel calls them out,  
His foes to mortal combat they defy,  
And think it honour at his feet to die."

“Your curiosity shall be gratified,” said I; “and I will convince you that the poet has told the truth about the loyalty of bees.

“The inhabitants of the hive are so intent upon their occupations, so busy in feeding the young, cleaning out some cells, and mending others, that they do not always find out immediately when they have lost their queen. But when, after a few hours, they discover her departure, a scene of tumult and consternation takes place. The bees are all in agitation; a peculiar humming is heard; they neglect their young, and rush backwards and forwards across the combs, as if they were frantic.

“It is singular to observe how the grief spreads by degrees through the whole hive. At first, only a few are aware of the loss of the queen; but they communicate it to the rest, by mutually crossing their antennæ, when they meet, and lightly striking them. By degrees the whole are informed of the sad story; some of the workers rush furiously out of the hive, spread all around it, then go in again, then again leave it to renew their search.”

“And does this tumult last long,” asked Letitia?

“No,” answered I, “not more than four or five hours. If the queen does not return, and you

observe the hive again in about four-and-twenty hours, all is tranquillity, and a scene of industry. Instead of wasting time in useless grief, the workers set about repairing their loss; and you will indeed think that I am relating a fiction, when I tell you, that they are able to convert the larva of a common working bee into that of a queen bee. This is one of the latest and most extraordinary discoveries relating to bees. It was made by M. Schirach, and confirmed by numberless experiments by M. Huber, whom I have so frequently mentioned to you. I will describe to you the whole process; and the more you reflect about it, the more astonished I am convinced you will feel.

“ They choose the young common worms whom they intend to convert into royal ones, and begin by enlarging their cells. In order to do this, they are forced to destroy two or three of the neighbouring apartments. We will suppose a set of bees about one of these cells; for the account of their labour will apply equally to all the others, as they all go through the same process.

“ The worm is chosen and deposited in its newly-enlarged cell: a large supply of royal jelly is then brought it; a cylindrical, or round tube,

is next formed around the bee ; the bottom of the cell remaining of the same shape as before."

SARAH. " They leave the bottoms untouched, I suppose, that they may not disturb the young worms in the three opposite cells of the double comb ?"

" Exactly so," replied I ; " but at the end of three days, a larger house becomes necessary for the worm, fattened by the rich food it has been feeding upon. On the third day, therefore, they gnaw through the three opposite cells, destroy the worms that inhabit them, and use the wax in building a new tube, which they fasten at right angles with the old one. They carry on their work downwards, and form the new tube wide at the top and narrow at the bottom.

" As the worm grows, the bees lengthen the cell ; and one bee after another may be seen popping its head in, and giving it a constant supply of food. This they place before its mouth, and round its body ; and the bee, which can only move in a spiral direction, keeps constantly turning to take its food, and thus insensibly descends to the opening of the cell. By this time it is prepared for its transformation into the nymph, or pupa state ; and as any farther care would now be




useless, the cell is closed with wax and propolis, in the manner before described, and the insect left to its fate."

"How very miraculous!" exclaimed my young auditors.

"It does, indeed, appear so," replied I. "That a larger and warmer house, food of a higher flavour, and a different posture, should cause the insect to have a different kind of tongue and mandibles, a longer body, more brilliant colour, and shorter wings; that it should give it the power of laying eggs and leading swarms, instead of collecting honey and forming wax, are facts that require very strong proof, I allow."

LETITIA. "Do you yourself give credit to this extraordinary fact?"

"Indeed I do, Letitia; for, besides my own observations, and the ten years' experience of M. Huber, I think another celebrated naturalist, Bonnet, has given a just explanation of its causes. A particular kind of food, given in greater abundance than usual, may cause in the grubs of bees the developement of organs that would never have made their appearance without. A more spacious habitation may likewise be absolutely necessary for the complete developement of the organs which this food causes to grow in every direction. The



wings are, you know, as short as those of the common bee ; and this too may be accounted for, from the stiffness of the substance of which they are composed, which does not allow of their increasing in proportion to the other parts of the body."

MISS R. " We must, I believe, yield to such excellent authority, for the truth of this singular fact. Pray tell me, whether it signifies what age the grub is when taken out of its own small cell, to be thus fed and enlarged into a royal personage?"

" Here again naturalists differ ; but I am inclined to join Huber in believing, that it is of little consequence how young a grub is ; and that one of a day or two days old, may be converted into a queen, as well as one of three or more days old. The following experiment, which I made, has, indeed, proved it. I had a hive, which had been deprived of its queen ; and I put into it some pieces of comb containing the grubs of workers, of about the same age as those in the comb. I then took five of these workers out of their cells, and put in five others, only two days old. The bees, however, did not appear to take any notice of the change, but watched over them and enlarged their cells, as for the others ; and after the usual time,

I opened the cells, and let out two perfect queens.

“ I have told you now what commonly takes place in a hive where the queen does not re-appear for twenty-four hours, especially if the hive be unprovided with any workers’ worms that can be converted into new queens. Their affection for the queen they have been accustomed to is sometimes too strong for them to get over so easily ; and I can relate to you a story of a whole hive-full who actually died for love of their queen. But I shall incur your censure for what, I must own, was an act of barbarity on my part, in order to gratify my curiosity. One morning, very early, I took a swarm of bees that had been hived the day before, and placing it on the grass, with a hard stroke upon the ground shook out all the bees in a lump. As soon as they were a little quieted from this disturbance, I got a little stick and stirred them about, till I succeeded in finding the queen.

“ Having put her into a box, which I had prepared for her, I carried her into the parlour, where I cut off her wings, to disable her from flying, and shut her up in the box.

“ I then returned to the garden, to see what the swarm would do when deprived of their sove-

reign, and I found them all in a tumult. Instead of keeping together in a cluster, like a bunch of grapes, as they usually do, they were spread out as broad as a cart-wheel, running up and down with a disconcerted tone, looking every where for their queen.

“After an hour or two of fruitless search, they flew away; and two things struck me as very singular in their flight: first, they flew to the very hedge on which the swarm had alighted the day before; and, secondly, they flew about in little groups of forty and fifty, searching in every direction, instead of flocking together in one bunch.

“I then took the box out of my pocket and opened it, to see if the afflicted bees would know their queen without her wings. To my great amazement, I no sooner opened the box, than all the little bunches of bees began to collect about it, and surrounded it on all sides. Presently they were all collected; and, no longer attempting to fly off in bunches, remained quietly about it, uttering their note of joy, so well known to those acquainted with bees.

“As night was approaching, I again hived them, and brought them into my garden. Next morning, I shook them off on the grass, as before, and

witnessed their affectionate conduct to their queen, whom they would not leave, although, from having her wings cut, she was unable to fly and lead them to a place of safety.

“ I took her away from them several times in the course of the day, and they as constantly spread themselves into parties to look for her, never failing to flock around her when I placed her in sight.

“ I had a party of friends with me, who were exceedingly amused at observing all this ; and when evening approached, and I put her down for the last time, we again perceived the faithful bees close round their mutilated sovereign, preferring to remain out on the cold ground without food, and starve with her, rather than desert her.

“ These faithful creatures spent five days in this manner, alternately looking out for her, and rejoicing over her when found. They tasted no food during the whole of this time ; nor would the queen eat the honey I set before her while parted from her subjects. At the end of the five days, they all died, except the queen bee, who lived a few hours longer, and then died too.”

“ Poor creatures !” said Letitia ; “ I wonder you could persevere in keeping them so long without their queen !”

“ You think me very hard-hearted, no doubt ; and, I fear, I shall scarcely excuse myself by saying, that my anxiety to ascertain how long the loyalty of these creatures would last, made me feel it a kind of duty to complete my experiment, painful as it was to my feelings.

“ I think I told you that it was the law of the hive, that one queen only should reign in it ; and that if more are allowed to live in it, it is only for a short time, when they are expected to lead out swarms. Except in this case, more than one can be introduced into a hive only by force, since the bees guard the entrance night and day, to prevent any intruders.”

SARAH. “ Here the workers turn soldiers then ?”

“ They make most vigilant sentinels ; for, not content with using their eyes, they actually touch with their antennæ, which, you know, are their organs of feeling, every creature that presents itself at the door of the hive. If a stranger queen approaches and attempts to enter, the bees on guard instantly seize upon her legs or wings with their teeth, and surround her so closely, that to enter would be impossible ; she cannot even move. Then, some other bees from within come to assist the guards, and form a cluster around

her. So closely are they packed, and so intent upon what they are about, that the whole bunch may be carried about for some time without their perceiving it. They have all their heads nearest to her ; and if they keep her too long in this painful imprisonment, she perishes."

LETITIA. "Is she stung to death by the other bees?"

"No: it has been said so, but without truth. Her death may probably be in consequence of suffocation from want of air, or from hunger ; but never from their stings. I have once seen an unfortunate queen in this situation stung to death, but it was my own fault. Out of compassion for her, I tried to get her out of the cluster ; at which the bees were enraged, and, in darting out their stings, some of them struck the queen, and she died. I am quite convinced, that if I had not interfered, the workers would have contented themselves with confining her ; and what makes me still more certain of it is, that some of the workers too were stung and died, which could not have been intentional."

LETITIA. "But will the bees never receive and pay homage to a new queen? It does not appear to me consistent with their notions of economy, either of their time or materials, to be

at the trouble of erecting royal cells, and nursing up young queens, if they could avoid it."

"I have said, that these labours are not commenced until they have been many hours without a queen; but even if they have been commenced, a stranger queen will be well received, and even allowed to reign as soon as she enters, provided there has been sufficient time for the bees to mourn over and forget their former sovereign.

"I have had an opportunity of observing this: my glass hive, last year, was deprived of its reigning monarch, and I introduced a new one, after the workers had actually begun to build twelve new royal cells. As soon as the stranger was placed upon the comb, the workers near her touched her with their antennæ, and, passing their trunks over every part of her body, gave her honey to eat. These workers then gave place to others, who treated her in the same manner; all vibrating their wings, and forming a circle around her. This agitation gradually spread, until it was communicated to the workers on the other side of the comb, who came in their turn to see what was going on. They soon arrived, and, breaking through the circle formed by the first, approached the queen, felt her with their antennæ, and gave her honey. After that, they retired be-



hind the others, and added to the circle, shaking their wings, and gently buzzing, as if they enjoyed some very agreeable sensations."

LETITIA. "This is a very interesting account of their orderly method of proceeding, and their unanimity. I suppose, then, they abandoned the royal cells they were beginning to construct?"

"Have patience, my good friend, Letitia," cried I, "and I will tell you in due time. The queen had not yet stirred from that part of the comb on which I had placed her; but in about a quarter of an hour she began to move. The bees did not oppose her, but opening the circle at that part towards which she turned, followed and formed a guard around her; and, after a short time, she began to lay eggs in the empty cells.

"While all this was passing on one side of the comb, the workers at the royal cells, ignorant of the arrival of a new queen, were labouring most diligently: they watched the royal worms, and supplied them with jelly.

"The queen at length reached this part of the comb, and was treated with the same degree of respect as she had met with from the others on her first arrival. The workers crowded around her, touched her with their antennæ, presented her with honey; and, as a complete proof that

they accepted her for their queen, gave over their labours upon the royal cells, removed the worms, and devoured the food that had been collected for their use. The queen from this moment was acknowledged by all the hive, and reigned as if she had been born and bred amidst her subjects."

SARAH. "I, too, remember reading a story about the attachment of the working bees to their queen. A celebrated naturalist, named Swammerdam, took the queen out of a swarm, and fastening her leg with a bit of cotton to the end of a long pole, drew her along. The whole swarm of bees followed and clustered around their queen, to protect and cover her; and thus all the swarm were led about in pursuit of their queen wherever Swammerdam chose to carry her."

LETITIA. "Since you have told your story, Sarah, I think I shall be able to tell mine, about a bee master, or, at least, a man who called himself a master of bees. Certain it was, that they followed him as sheep follow their shepherd, and even closer too, for he was entirely covered with them. His cap looked exactly like one of those swarms which, when they are about to settle, fix on some branch of a tree. The people about him bade him take it off, and the bees then placed themselves on his head, or shoulders, or

hands. They never attempted to sting him, nor any of the persons near. They all followed him when he went away, and he had myriads around him, besides those upon him. Although much pressed, he never would tell the secret, but only said, that he was master of the bees."

"Ah, the juggler!" cried I. "He had, no doubt, secured the beloved queen of the swarm, and had her safe either in his ear, or some other place that the bees were aware of."

After thanking my young friends for their amusing additions to my store of anecdotes, I entreated them to enter my arbour and partake of some strawberries and cream; over which we laughed and talked, till the shades of evening warned their prudent but most kind governess that it was time to depart.

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## CHAPTER VIII.

"THE next subject which will occupy our attention," said I, when again my auditors had put on the appearance of anxious listeners, "will be that of the swarming of the bees, which I can no longer

delay telling about; because I have received a hint, that several of the party will not be able to make observations for themselves, in consequence of the coming holidays, which will take them from their studies."

"And from our amusements, too," cried Letitia; "I shall pine for these charming Saturday afternoons, even when enjoying myself with all my friends at home."

I smiled at the warmth of my young pupil; but thought to myself, that she would shortly change her note. However, I felt that we had no time to lose, and entered at once upon my subject.

"The usual swarming season is from the middle of May until the middle of June; but swarming may take place earlier or later. Much depends upon the state of the weather; for no swarm will ever leave the hive while the weather is cold, or the hive not perfectly stocked with eggs."

LETITIA. "And do the bees give you no warning that they are about to swarm?—Do they fly out in a bunch quite unexpectedly?"

"No," replied I; "nothing that my little friends do is hastily performed, or without due reflection and preparation. But come, let me take you to the numerous hives in my garden;

perhaps, at this very moment, some of their inhabitants may be busy preparing to swarm. Now is the season, and the sun shines most kindly." I was followed, not without some hesitation and lingering steps, into my garden ; and as we passed along the range of hives, whose entrances were thronged with clusters of busy bees, Letitia cried out, " Ah ! what noise is that I hear ? It sounds like an unusual humming !"

" We are fortunate," said I : " this gentle humming is the prelude of a swarm ; but do not be terrified ; the bees will not start out and alight upon your head or shoulder. Swarms never set out at this time of the day, but they are making preparations for the morrow. This humming is one of the signs : another sign is their having kept house to-day ; for scarcely any of the bees in that hive have pursued their usual labours in collecting honey, or pollen. The hive, too, appears so full of bees, that many thousands, as you see, hang upon each other in clusters at the entrance ; this is another sign. I see too some drones, or males, making their appearance ; this, again, is a sign : and to-morrow, doubtless, there will be a swarm issuing from this very hive."

" But what," asked Sarah, " can be the meaning of this perpetual hum ? I have held my ear

close to the hive, and it has not ceased for an instant ?”

“I must leave you, Sarah, to form your own conjectures, to add to the amusing ones already invented. Some people say, the noise is occasioned by the queen, who makes a speech to her subjects before she leads them out. Others say, that she rouses them with a kind of trumpet, to give them courage for their undertaking ; while others, still more fantastic in their notions, say that the noise proceeds from the young queens, who sing out a kind of petition, that the old queen will allow them to leave their cells and lead out a swarm.

“All this, of course, is mere fancy ; and we may as well attempt to interpret the conversations of birds, when they utter responsive notes to each other. The noise you hear, whatever it may mean, is occasioned by their striking their wings against the air ; and the vibration of a single pair of wings, moved forcibly and swiftly, will produce a considerable hum. Except their wings, the bees have no other organs of voice ; and if you cut off the wings of a bee, you render it quite dumb.

“I have told you, that the bees, who have instinct adapted to every situation in which they

are placed, carefully guard their young queens, if swarming season is at hand ; and, by keeping them imprisoned for a few days in their cells, prevent them from falling a sacrifice to the jealous fury of the old queen. The first swarm, or colony, which wings its flight from the parent hive, is always led by the old queen ; whose frenzy, when she finds herself repulsed in all her attempts upon her rivals, amounts almost to delirium.

“ About eleven o’clock in the morning, when the sun has warmed the air, is the time that the swarm generally issues from the hive : the hum increasing as the time approaches for the little beings to set out on their adventures.

“ The queen, whose body has become very slender, as if in readiness for her flight, shews great signs of agitation. She still continues to examine the cells, as if going to lay, but suddenly withdraws, without having laid. Sometimes she deposits her eggs irregularly. Her whole movements are disorderly. She runs over some of the bees in her way ; sometimes, when she stops, the bees who meet her, stop also, and look at her attentively ; then striking her with their antennæ, mount upon her back. Thus she continues her route across the combs, with some of the workers

upon her; none offer her honey, but she helps herself from the combs as she goes along. None pay her the usual attention and homage, or form the regular circles round her, but run after her, and rouse, by their agitation, the workers who were still busy in the combs.

“ You may trace her path across the combs, by the agitation which is every where excited: it is never quelled, and the queen soon runs through the whole hive, and causes the tumult to be general. If any corner still remains quiet, some of the agitated bees soon arrive and disturb it. The queen no longer lays her eggs in cells; she lets them fall at random, and the workers neglect to feed the young brood; those even that are just returning from the fields, laden with newly gathered stores, no sooner enter the hive, than they become affected by the general agitation, and run blindly about, careless of the baskets full of pollen which encumber their feet.

“ At length they all rush precipitately to the entrance of the hive, the queen accompanies them, and the swarm issues forth.

“ The cause of this last rush, is, doubtless, the heat of the hive, which is so increased by the queen’s restless movements, as to become intolera-



ble: the bees clustered near the mouth and at the bottom of the hive, perspire so much, as to appear drenched with wet."

My lecture was here interrupted by an earnest petition from my young hearers, that it might be postponed, and that they might come the next day and take their chance of seeing the bees issue from the hive they were now examining, and which I had assured them was on the point of swarming.

I, of course, could make no objection; and Miss R. kindly sanctioning the petitioners, I was soon left again to my solitary reflections, with a promise from the party to be with me early in the morning, and a parting exclamation from Letitia, of "Oh, how lucky, that we should discover a hive ready to swarm!"

The next morning, the sun shone brighter than usual; my breakfast was over, and my gardener was busy preparing a hive for the reception of the new colony, when up came the rosy group of white and green damsels, out-walking their more sober-faced governess, and almost as disorderly and agitated as my bees themselves.

"We are in time, I hope," said Letitia, who brushed her hair away from her eyes, and tried to look calm and cool, as she first reached my garden-



10



Page 117.

11



Page 118.

12



Page 122.

gate : " Don't tell me the bees have left the hive, or I shall break my heart ! " .

" Do not distress yourself, Miss Letitia," answered I, very gravely. " You are in good time. Let us wait for the rest of the party, and then we will quietly station ourselves at the hive, and wait the forthcoming of the bees.

I soon found by the increased hum, that the swarm was about to issue, and gave due notice of it to my visitors, lest they should be terrified at the sight of so many enemies.

Some of the bees at length flew out. " See, see ! " cried Letitia : " What a cloud of bees ! I never before saw so curious a sight ! They rise in the air all around us, like flakes of snow in a winter's day ! Whither are they going ? They hover about, as if uncertain which way to turn !— Is the queen with them ? " .

" You shall soon see her," said I ; and, throwing some handfuls of small gravel up to the swarm, to prevent them from ascending too high in the air, we soon saw them alight upon the branch of an apple-tree just near. I encouraged the girls to follow me, and when we reached the tree, I was able to point out to them the queen, at a little distance from the tribe of bees who had clustered around the branch.

As soon as the group was quite formed, the queen entered into the midst of it, and the bees surrounded her so thickly, that we lost sight of her.

LETITIA. "The group is very quiet, how long will it continue so?"

"Until the gardener has prepared his hive," answered I. "In the mean time, let us observe how this living ball of animals hang upon each other by their claws. Now the queen has joined them, they are quite quiet; not one leaves the general assembly to roam abroad."

"I have heard," said Sarah, "stories of brass pans and kettles being sounded when the bees swarmed: what was this for?"

"For the same reason," said I, "which made me throw dust up to them, to prevent them from soaring out of reach. The peasants know that the noise of thunder invariably causes bees to return downwards to their hive, and they take the best method they can of imitating this noise.

"Their observations are just, as far as they go; but this plan does not always succeed, because it is not, in fact, the noise of the thunder which brings the bees so hastily back, but because they have instinct enough to know, that thunder is generally followed by rain; it is the rain they fear,

and the approach of it makes them anxious to be under the shelter of their hives.

“ Now my expedient of throwing up dust, or fine gravel, is more ingenious, I think, and seldom fails ; for the bees mistake the minute particles for small drops of rain, and fancy the storm to be commencing.”

“ But what would happen,” asked Letitia, “ if the bees were left to themselves, and winged their flight as high as they pleased ?”

“ They would stand the chance of being lost in the trackless regions of air ; and, at all events, they would be lost to us. Our observations would be at an end ; and, if gain were our object in keeping bees, we should be poorer by the whole hive full of honey, which we naturally reckon upon from every new swarm.

On these accounts, we plant our hives in gardens ; and a careful bee master, like myself, will allow of none but dwarf and bushy shrubs to find admittance there ; large trees would not only endanger the lives of my little subjects, but encourage them to become rebellious, and place themselves beyond the reach of my gardener, who is now so diligent in preparing a warm and safe habitation for them.

“ I must not omit another amusing fiction re-

lated of bees, which is, that on the day before the swarm is to take place, spies are sent out from the hive, to choose a proper place for the new colony to establish themselves in ; and when they return, and have made their report, her majesty, the queen, sends some of her officers of state to prepare the place for her reception.

“ But that this is merely a fable, we may ourselves judge ; for if they had exercised their usual foresight, the swarm we are now watching would never have chosen that branch of a tree, exposed as they there are to every gust of wind and every drop of rain.”

LETITIA. “ But how can you tell that they intend to fix there ; and that they are not merely resting themselves, and preparing for another flight ?”

“ I know it ; and you shall soon judge of the truth of what I tell you with your own eyes. When the gardener has housed them, you will find that they have actually been all this time busy building combs in preparation for a residence there. It is possible, that when they had found out all the inconveniences of the situation, they might leave it, and seek a better ; but I have no doubt that their present intention is to remain where they are.”

LETITIA. "I can have no hesitation in trusting to your report: and pray tell me, if it ever happens that two queens go out with one swarm?"

"It is not an uncommon circumstance," answered I; "but, in that case, the swarm invariably divides itself into two bands; so that if they are all clustered in one wreath, as you see here, you may be sure there is only a single queen.

"The swarm, though at first it divides itself, when it perceives that it has two leaders, soon becomes aware that it is not for the general interest to part, and the smaller band at length joins the larger one; the queen whose luckless fate it was to belong to the smaller party, falling a victim to the jealous fury of her more fortunate sister-queen.

"Till this contest is decided, and the affections and duty of the bees are all centered in one queen, no business is begun, nor even an habitation fixed upon.

"It sometimes happens, that a swarm goes out without a queen; but as soon as this is known to the whole party, they return to the hive from which they issued."

LETITIA. "What a pity, that, when there are too many queens, one should not be secured, and given to the swarm which wants one."



“The same idea,” said I, “entered into the head of Reaumur, a most indefatigable French naturalist, and he made an experiment of introducing an old queen, who had frequently led swarms, into a hive which was overstocked with inhabitants, and which only wanted a queen to lead them forth. Next morning, when he looked into the hive, he found the queen, whose throat he had marked with red, that he might know her again, lying dead among the workers; some of whom afterwards carried her out of the hive to some distance from it. Thus his experiment failed.”

LETITIA. “Look! look at the gardener, with a piece of gauze over his head, a great pair of gloves on, and a broom in his hand!”

“He is a careful old fellow; and the gauze over his head may sometimes be a necessary guard. I will tell you what happened to my maid Kitty, who is now a very heroine among the bees.

“The first time I required her assistance in hiving my swarm, she put a cloth over her head and shoulders, upon which the queen bee perched, and in an instant she was covered thick with bees. When the cloth was taken off, she was quite a spectacle, her face and neck being quite black with them. She was so terrified, that she wanted

to run off, but I persuaded her to be quiet, and let me hunt for the queen bee.

“ I presently found her, and removed her into the hive, but the bees still kept their station upon poor Kitty. I gave another hunt, and found a second queen, which I removed likewise, and the bees immediately followed her into the hive, and left Kitty unhurt, and so brave, that she now is ready to assist me in any enterprize among them.

“ But to return to old John : he has carefully cleaned out his hive, and rubbed the inside with such leaves and flowers, the fragrance of which he knows the little bees are fond of. Such as balm-leaves and bean-flowers, and a little honey he has perhaps put in to coax the new comers.

“ These precautions are not absolutely necessary ; but the old fellow is determined to omit nothing to entice them in. See how he sets to work.”

LETITIA. “ He approaches them cautiously, and reaches them with his little broom, but,—oh, John ! you are very clumsy !—large clusters have dropped down upon the ground, instead of into the hive, and many are flying away !”

“ Never mind, Letitia ; he has done very well. He has turned the hive up into its right place on the stand ; and those who were groping on the

ground, or flying away, are now eager to join their friends within."

"Yes," said Letitia; "but how many of them are returning to the branch of the apple-tree!"

"They are partial to the place on which they first alight, and it is often a very difficult matter to make them entirely leave it, for they will return thither again and again, although driven away every time. We will get John to rub the bough with some elder-leaves, or some rue, and their dislike to the smell of these will prevent them from visiting it again, and we can then approach and see whether they have begun their combs upon it.

"At present, the gardener is busy in driving four stakes round the hive. Over this he will spread a cloth, and, as the sun is now very powerful, he will likewise spread a few branches, to form a more complete shade, for it would not do to remove the hive at present. After sunset, he will carry it to a stand by the side of the other hives, whose sheltered situation protects them both from heat and rain."

LETITIA. "Now suppose, that in spite of all your precautions, a new swarm of bees should sometimes perch upon a branch above the reach of John's arm, what would he do to bring them down?"

13



*Page 124*

14



*Page 125*

15



*Page 130*



“I am glad to perceive,” said I, “my friend, Letitia, so anxious to know every thing so thoroughly. A few days would, probably, enable you to have an opportunity of seeing his operations; but, as you may not be on the spot at the exact time, you shall hear what expedients John’s sagacity provides him with in such a case. Sometimes he mounts a ladder, and holds the hive topsy-turvy, while my maid Kitty, who is almost as great a bee manager as myself, mounts up some steps, and with a long broom sweeps the bees into the hive. If the swarm alight upon the end of the bough, so that the ladder cannot be placed near enough to it, the hive is inverted, and set up on a long thick pole, and a very long broom employed to sweep the bees into it. Other expedients are resorted to, according to the situation of the bees; but if all should fail, they must be suffered to remain till evening, when they get drowsy, and can be more easily managed.”

LETITIA. “I have ventured near the new hive, and long to see how the little industrious creatures set to work. How long will they continue in this quiet state? I hear no noise, nor any sign of life.”

“You may depend upon it, if John has taken proper care to make their house agreeable to

them, it will not be long before they set to work. Quiet as they seem, many have even now mounted to the top of the hive, and begun a comb ; and not many days will elapse, before these cells will be filled with eggs. We shall not get a sight of it till it is many inches long, for they throng to relieve each other from their labour. None, as you perceive, have yet attempted to fly abroad ; and, therefore, we must suppose they brought upon their bodies a store of wax to begin building with. All we can perceive is, that they have flown to the very top of the hive ; and since they begin building always at the top, it is a sufficient proof that they are satisfied with their abode."

MISS R. now suggested, " that as they had seen the bees safely lodged in their hive, her party should retire, since the morning's lecture, agreeable," she politely added, " as it was, rather interfered with their usual employments at home."

Letitia just begged leave to ask one question before they left.

" How many swarms will a hive send out in one season ?"

" From three to five ; and sometimes, at intervals, five or six in ten days. Even this new swarm may send out another ; but this is not common, unless the first swarm be very early."

SARAH. "As Letitia has been allowed to ask a question, perhaps I may venture to ask if you can tell me how many bees there were in the thick bunch we have just seen hived?"

"That was a small swarm; yet I should think it contained about twelve thousand; I have seen one so numerous as to contain forty thousand. But the numbers vary very much, as well as their ages; for, I can assure you, it is not the young bees alone who follow the swarm, for old, as well as young, emigrate to the new colony."

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## CHAPTER IX.

THE visits of my young friends now became more frequent; partly because they were soon to cease altogether, and partly because they were becoming more and more interested with the subject, as they felt themselves better acquainted with it.

I was intently looking into my glass hive, one morning, and in my eagerness exclaimed aloud, "Ah! the rascal, he is caught!" when a gentle laugh behind me made me turn round.

"Ah, Letitia!" cried I, "you are just come in



time to share my indignation, and see the robber punished for his crime."

"Robber!" said Letitia. "Are there such things as robbers among your friends, the bees?"

"Can you wonder that the sweet treasure collected by this industrious race, and so carefully stored up by them, should become a source of envy and desire to the idle, who will not take the trouble to reap for themselves?" said I. "See this great wasp, he now lies dead, after a most furious contest with several of the bees, whose cells he had invaded, in order to plunder. This race of pirates, these wasps, are among the most persecuting enemies the bees have: sometimes, they attack them singly; but generally, they enter the hive in a body, and plunder it without mercy.

"I must confess, however, that we have no right to be indignant at these robbers; for, after all, who can be greater enemies to bees than men, who entice them to labour, in order to destroy them, and take possession of their honey.

"Bees are assailed by numerous enemies, and are obliged to exercise constant vigilance, both in guarding and fortifying their hive. Wasps and hornets are more formidable than any. I have often seen them wind round and round a hive, watching an opportunity of attacking a bee, who, after

hours of labour, is returning, loaded and tired, back to his hive. The bee finds little assistance from its sting, and in vain attempts to escape from her enemy, who kills her in a moment. I have seen a wasp pounce upon a bee, dart off with it, rip open its honey-bag, and devour its contents. Even while bees have been employed in sucking the honey out of the nectary of a flower, have I seen them carried instantly off by hornets or wasps. Just as the poor robin is snatched away by the hawk or kite ! Sometimes, they join together in bands, or troops, and attack and enter a hive : a bloody battle ensues, and lives are lost on both sides ; but the wasps are generally victorious, and carry away with them a rich booty of honey."

LETITIA. " These are hateful enemies. I little thought that any thing could have increased my aversion for wasps ; but this account of their idleness and gluttony makes them appear quite odious to me."

" You never expressed yourself so warmly against the bees, Letitia," said I, " much as you suffered from their stings. I must find a word, by and by, to say for the wasps. In the mean time, let us return to the enemies of the bees, for they have thousands besides wasps. Among ani-

mals, the bear and the badger are partial to the sweet taste of honey, and overturn the hives to plunder their contents; as for rats and mice, those universal robbers, there is no end to their thefts. They invade them at all times, but particularly in the winter, when, being in a torpid state, the bees are unable to defend or avenge themselves.

“ Birds, too, appear in the train of robbers: the woodpecker can break through the hive and destroy all its inhabitants; while the swallow picks them up, and devours them like grains of corn. Another bird, called the *bee-eater*, the sparrow, the cuckoo, and the titmouse, are all enemies to the bees. The titmouse makes a noise at the door of the hive, and when a bee comes out to see what is the matter, seizes, and eats it up. He will swallow a dozen at a time. Poultry of all kinds devour them singly.

“ Lizards and toads are said to watch for them, and swallow them. These are open warlike enemies. Spiders have also been reckoned among the number; but as their plan is to spread their tiny nets for the thoughtless and the idle, it is not often that they can boast of a victory over the industrious and sagacious bee.

“ I believe it is an equally mistaken notion, that

16



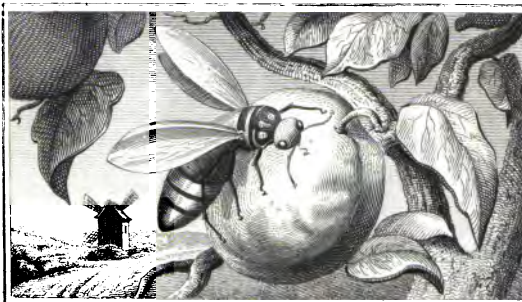
*Page 130.*

17



*Page 134.*

18



*Page 153.*



ants are enemies to bees ; for a small colony of these insects once planted themselves on the outside of the shutter of my glass hive. When completely settled there, I removed the shutter, and the bees and the ants continued within sight of each other without either attempting to interfere with the other.

“ Knowing the ants to be exceedingly fond of honey, I thought it might be modesty which prevented them from attacking the bees ; but I found afterwards, that it was fear which kept them back ; for, as soon as the bees had left that part of the hive, the ants entered, and ate the honey out of the cells.

“ Slugs and snails blindly creep into the hives, without knowing whither they are going ; but these are enemies which are soon got rid of.

“ Bees, too, are sometimes infested with vermin, clean as they keep both their persons and their habitations. There is a reddish kind of flea, which sticks to the bee's breast and neck, and, though it cannot pierce the scaly armour which covers the body of the bee, it creeps in between the joints, and sucks her blood. Young bees are never troubled with these little insects, which are no bigger than a very small pin's head. They do very little harm, but the hives into which they

have obtruded, are not considered so valuable as others ; since it is a sign that they contain chiefly old bees.

“ Moths, of various kinds and sizes, are the most sly, as well as the most destructive enemies the bees have. The *wax-moth*, so called on account of the havoc it makes in the wax, though but a small caterpillar, delicate and tender in its body, unarmed, and defenceless, can make its way, and feed upon the labours of many thousand warrior bees, defended by scales, and armed with a murderous sting ! Ten or twelve of them will bore through a comb and break it to pieces ; then, with the materials, build up a habitation for themselves, and thus oblige the bees to quit the place.”

“ How very curious !” exclaimed Letitia and Sarah at once. “ Pray tell us more of this sly, but clever thief.”

“ I could tell you much,” answered I, “ of this curious insect tribe, called moths, and much that you would scarcely believe. I need hardly apprise you, that we apply the general term *moth*, to all those little worms which feed upon our clothes, our books, our furniture, &c.

“ Some of these cut themselves out clothes, which they put on, walk with, and live under, as

long as they continue in the caterpillar state. Others, more ingenious still, make themselves umbrellas, beneath which they crawl; while others have the art of building whole galleries, which serve both for houses and clothing. The whole life of a wax moth is curious. An egg, so small as to be almost imperceptible, has been dropped by some stray moth into the corner of a honey-comb; in a few days, it is hatched, and a small caterpillar issues from it, so minute that it escapes even the penetrating eyes of the inspector-bees. With the utmost swiftness, this little thing, born in the midst of enemies, spins itself a house, in the shape of a tube, or gallery, large enough for it to move up and down in. This she glues to the waxen comb, which also provides her with very nice food. Peeping out of her gallery, she finds the same kind of food all around her; and, as she feeds and grows, her house becomes too small for her; she increases it, and thus eats her way through several combs, whose foundations being thus destroyed, soon give way. Finding, as she proceeds, that she is surrounded with enemies, she takes the precaution of building a stronger wall to her house, and mixes little bits of wax among her silken threads. The wax she contrives to stick upon the outside of her house, as well to pre-



vent the bees from finding out her silken habitation, as to be a defence against their stings. The inside of her gallery continues a close texture of white silk, so soft as not to injure the tender body of the insect which moves to and fro within it."

LETITIA. "This is very curious; and I am amazed how it is that the bees, so strong, so active, and so clever as they are, have not found some means of extirpating these troublesome moths."

"I have not yet," said I, "told you all they have to suffer from them. There is one species—*Tinea mellonella*, who make frequent attacks upon the hive, and try to force themselves into it.

"The bees, when they expect such an attack, place sentinels about the entrance of the hive. I have watched them by moonlight, pacing about with their antennæ stretched, and moving from right to left. I have seen the moths flutter about the entrance; and, apparently aware of the blindness of the bees, attempt to glide in between the sentinels, and to escape the touch of their antennæ.

"The bees on guard in the night utter a low hum; but if their antennæ touch one of these moths, or any other enemy, the hum becomes louder; a commotion is raised, and the moth is

quickly attacked by a body of workers from within.

“ The *death's-head* hawk moth is another enemy, from whose attacks they guard themselves in a very different manner.

“ In the autumn, when their storehouses are full, a band of these *death's-heads* will contrive to get into the hive during the night, when the bees cannot see them. A great tumult takes place; a battle follows; and, the next morning, the ground about the hive is strewn with the dead bodies of bees; the hive has been robbed of all its honey, and the bees never return to it.

“ To prevent these disastrous incursions of the *death's-head* moths, I generally have the door-way of my hives so narrow as only to admit a single bee at a time. But the bees themselves will sometimes fortify their hives. They build a thick wall, which resembles a regular fortification, with towers and huge gateways. This wall, constructed of wax and propolis, is erected behind the gateway, and pierced with little holes sufficient for one or two workers to pass through.

“ The fortifications are varied according to circumstances. Sometimes, they consist of one wall, as I have described, with the holes resembling arcades at the top of the building; sometimes, of

a row of little towers, one behind another ; and sometimes, of a succession of walls, with gateways in different parts of them. But they only take this great trouble upon urgent necessity, and demolish them, when the danger is over, until the next season, when they perceive fresh signs of their enemies.

“ That they never construct these fortifications when the door-way has been already made so narrow, that they can have nothing to fear from these enemies, is a proof that our friends, the bees, are not wholly guided by blind instinct, entirely independent of all foresight and prudence.

“ But, however vigilant,” continued I, seeing my party still disposed to listen, “ bees are to keep off their real enemies, they are not ill-tempered if unmolested. I have given you several proofs of this ; but when their anger is once roused, they are indeed formidable creatures.”

“ I think I can testify to that,” said Letitia ; “ for the offending foot, which I unawares set upon their nest, still bears marks of their anger.”

“ Nor is their anger,” said I, “ confined to man : I have already told you the effect of it upon some of their own brethren, the males, who are massacred as soon as they are known to be no longer useful to the community. There are bees of a

different kind, occasionally found in hives, whose heads and throats, having less down upon them, appear blacker than in other bees, and who therefore go by the name of *black bees*. These are always driven from the hive, and often killed ; but the reason why, has been only conjectured, and is so unfavourable to my little favourites, that I am unwilling to explain it."

MISS R. observed, that it would scarcely be acting fairly as an historian, to mention the good, and keep back the unamiable traits.

"It has been supposed, then," continued I, "that these are the aged and infirm bees, who can no longer assist in gathering honey, or in feeding the young, and who are therefore useless within the hive.

"But what say you to a regular pitched battle among the bees themselves? This sometimes takes place, and may, I hope, be equally traced to their notions of public good. In these battles, the bees are so eager, that it is difficult to part them : their whole aim seems to be to pierce each other with their stings, which, if once entered into the body of the bee, give certain death. The conqueror is sometimes unable to extricate his sting, and then he also dies. For an hour, or even longer, this combat will last ; and often, when the fighters are

tired, they give up the contest in despair, and fly away.

“I have watched a combat of this kind with great interest; and I have seen, too, one swarm attacked by another that has chanced to take a fancy to the hive it occupies.

“If strange bees enter a hive, they are almost sure of being attacked; and a long and well-fought duel is often the consequence. In this case, the victor carries off the bee she has been fighting; and, bearing her between her legs, after flying, sometimes to a great distance, sometimes to a short one, deposits it on the ground. Beside the dead body, the bee rests itself, standing upon its four front legs, and rubbing its hinder ones together. Occasionally, the swarms of different hives seem to meet upon friendly terms. I once noticed a set of bees, visiting, as it were, another set; and each bee seemed to be questioned as it entered the hive. But this friendly intercourse ceased after a few days, and a deadly battle ensued. These battles, in general, however, are fought in defence of their property. Ill-managed bees, who are not supplied with the necessary quantity of honey, actually turn robbers, or, as some call them, *corsair bees*. Early in the month of August, they begin their thefts; at first trying to enter a hive by stealth,

and then growing bolder and attacking it in a body. If either of the queens be killed, the party to which she belonged joins the other, and assists in pilfering the stores of the hive. The most amusing sight, perhaps, is to see two or three robbers attack a solitary bee. One seizes it by one leg, a second by another leg: perhaps there are two on each side, who hold the legs or throat. The poor wretch thus assailed, puts out its tongue, which one of the robbers instantly goes and sucks, and when he leaves it, the rest follow his example. As their aim is merely to steal its honey, not to kill it, they then release the poor unfortunate creature.

“But it is not the general character of bees to be unkind to each other; for I have often seen them assist one another in gathering honey from the flowers.”

I was well pleased to be interrupted by Letitia, who said, that, since she last saw me, she had met with a curious story of an idiot boy, who devoted himself to bees. He fed upon them, and they formed his chief amusement. In the winter, he dozed in an arm-chair, by the fire-side, in his father's house, while in summer he was actively employed in hunting bees. He was never afraid of them, but would seize them with his naked

hands, and, pulling the sting out, would suck their bodies for the sake of the honey-bags. He would delight to fill his bosom with them, between his shirt and skin, and would stuff bottles full of them. He was an enemy to bees and to bee owners; for he would steal into their gardens, sit down by the hives, rap them with his fingers, and catch the bees as they came out. In fact, he was so ravenous after this food, that he would even overturn hives for the sake of eating the bees. Whenever the neighbours were making mead, he would linger about, begging a draught of bee wine, as he called it. This lad would make a sound with his lips like the buzzing of a bee; he was pale and sallow; and, except in hunting bees, shewed no capacity whatever for any thing.

We all joined in thanking Letitia for this story; and the party then left me, "fearing," they said, "that they should not have many more visits to pay."

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## CHAPTER X.

"I HAVE some few particulars," said I, the following Saturday, "relating to our friends, the

bees, without which the history I have been giving you would be incomplete. For instance, we have seen a swarm leave a hive, conducted by a young queen, and safely lodged in a new habitation: let us now go to the same hive, and learn what took place in it after that event.

“The old queen, you may remember, led forth the swarm; and this fact, which has only recently been discovered, appears rather singular at first view of it.”

LETITIA. “Yes, indeed; I should have thought it wisest if one of the young queens had led a colony out from the parent hive, and left the old queen still to reign over her own faithful subjects.”

“However astonishing it may seem, I shall be able to give good reason for this regulation. In order to prevent the plurality of queens, their jealousy of one another is unbounded; and, therefore, at the time the young queens are just ready to escape from their cells, the agitation of the old one makes her quit it with a swarm, and this prevents the massacre of queens, which would otherwise take place.

“When the remaining inhabitants of the hive find themselves without a queen, their attention is



turned to the royal cells, in which, for some days, they had been guarding their young queens.

“ I told you before, that the queen only lays royal eggs every third day, so that they arrive at maturity one after the other, which is an admirable arrangement; for if they were all to burst out at once, all but one would soon be destroyed. The fact, that the workers who are on guard know which is the oldest, and let her out first, is a very singular one.

“ The eldest then is hatched, and the workers take but little notice of her, until she tries to approach the royal cells which contain the others; then the workers bite and pull her, and force her away. Wherever she turns, she finds royal cells, which she desires to attack, but is restrained by the workers, until she becomes so agitated, that she paces about the combs, and, communicating her disorder to some of the workers, they also become restless, make a rush to the entrance, and depart, with the young queen at their head, making a second colony.

“ After the departure of this second swarm, the workers set free another queen, who acts in a manner very similar to the last. Thus, a populous hive will send out three or four swarms in succes-

sion. Between the two first, there is generally an interval of nine or seven days; between the second and third, a shorter time; and the fourth often leaves the hive the day after the third.

“You will allow, that the bees have an excellent reason for confining their young queens; and I can add an additional one. It is quite necessary that they should swarm only on a very fine day; and if it turn out wet, contrary to their expectations, all the preparations they have been making are postponed until a better opportunity. Had the royal cells, therefore, all been opened, and the young queens liberated, there would have been too many in the hive, all but one must have been killed, and none left to lead the colonies.”

LETITIA. “You mentioned, just now, that the young queens were liberated from their imprisonment according to their ages: how is it possible that their guards could discover which of the eggs were laid first?”

“Indeed, Letitia, many and many a conjecture has been wasted on this subject; but I am disposed to think, that it is by the humming sound emitted by the bees when they have entered the imago state, that the attentive workers are aware which it is their duty to set free. I have fre-

quently heard this hum, and fancy I can even distinguish that it is stronger from some, probably from the older bees, than from others.

“It is after the swarming season, at the beginning of autumn, that the massacre of the males, or drones, takes place, when the bees are preparing for the winter, and desirous of having as few mouths as possible to consume their winter store.

“When the weather becomes too cold for them to fly abroad and procure food, they live upon what they have already collected. Bees are not torpid during the winter, as some have supposed. And therefore great attention is necessary to supply them with honey if their store be exhausted, for fear of their being either starved, or forced to turn robbers.

“The temperature within a bee hive is much warmer than that of the open air; and the bees move about and cluster together, to preserve the heat. Among the various duties of bees, both in summer and in winter, is the ventilation of their hives. How much they stand in need of this, you may imagine, when you reflect upon their small confined habitations, the many thousands each contains, and the small opening, which is the only channel for the air to be admitted through.

“Bees can expel the air from within the hive,

and can attract the external air; and they do it in the following manner: they close their two wings together, so as to form them into something like a fan. These they move rapidly up and down, until they become almost invisible, and while so doing, they fix themselves firmly to the bottom of the hive by their feet and claws, stretching their first pair of legs forwards, and spreading out the second pair to the right and left; the third pair being placed close together under their stomach.

“The workers only are employed in this office; sometimes twenty of them are engaged at once, some within, some without. Those within turn their back to the entrance, those without turn their head towards it. One bee can continue for half an hour at this occupation, scarcely taking a moment's rest; and when it leaves off, its place is instantly supplied by another bee; so that the business of ventilation, in a well filled hive, is constantly going on. And by the incessant humming which accompanies it, you may always know what the bees are about.”

MISS R. “After all I have heard you relate of the wonderful monarchy of bees, I cannot help deploring bitterly the cruel method of destroying all the inhabitants of the hive, whenever the honey

is taken. Have not you, and other lovers of bees, contrived some means by which you might be robbers only, instead of murderers?"

"I deplore it as much as you do," answered I: "and that it remains a practice at present, must be attributed to the wilfulness of habit and prejudice. Would to Heaven, that I could persuade others to adopt the more humane, as well as economical plan I have long used with mine; I could promise them, that, by sparing the lives of the bees, they would double their own gains the next year.

"To stifle the bees with the vapour of brimstone, which they set on fire in a hole in the ground, over which they place the hive, is the plan sometimes adopted; and there are various others, the effect of which is the same. The country people apologize for this unnecessary barbarity, by saying that the bees, being old, would be unable to lead forth new swarms, or to collect honey in the ensuing year; and that they would consume too much honey during the intermediate winter.

"Thus I close my history of the hive bee, the most interesting, if not the most useful, of all insects. There are various other kinds of bees, but few of which we have any particulars.

“The *wild bee*, whose nest Letitia trod upon, generally builds her cell in the hollows of decayed trees.

“I could enumerate between fifty and sixty different kinds of bees; and some of them with peculiarities truly amusing; as, the *black bee*, which sleeps within the flower; the *red bee*, a native of Europe, which perforates trees, and, boring a hole through them all across, builds her cells and deposits her eggs within the hole. This bee is red, and very hairy on the body, with wings of a bluish tinge.

“The *muscorum*, or *yellow hairy bee*, has a white belly, and builds her combs in mossy grounds, in order to form a nest of this soft material. These bees set to work in the following manner: they form themselves into a chain, from the nest to the place where the moss was laid. The foremost in the chain tears a bit of moss up with its teeth, and cleaning it piece by piece with her teeth, (for which they are called *carding bees*) passes the unravelled morsel, by means of her feet, beneath her body, on to the next bee, who passes it on, in like manner, to the third. A continued chain of moss is thus formed, which is interwoven with the nicest skill by those nearest the nest. When the whole fabric is completed, they

shelter and protect it by means of an arch of wax, thin, but tenacious, a substance not exactly like common bees' wax.

“ Another and still more curious kind of bee, is the *leaf cutter*, or *black bee*, whose nest is made of leaves curiously plaited in the form of a mat, or quilt. There are several varieties of the leaf-cutter, all equally industrious and ingenious. Some dig into the ground, and form cells resembling so many thimbles, one within another; others give them the shape of goose-quills. These are all composed of bits of leaves. Each kind keeps to its own kind of tree, some the rose-leaf tree, others the chestnut. A careful observer may discover rose trees, cut as it were with a pinking iron, and may procure himself the pleasure of seeing with what dexterity a bee, destitute of any instruments, can cut out a circular piece of a leaf, suited for the bottom or for the lid of his habitation. The sides of these are formed of oval pieces, of the same regular dimensions. Into these cells, an egg, with appropriate food, is deposited by its skilful architect.”

LETITIA. “ I have been hoping, among this list of bees, to hear some account of that beautiful one, which we call the *humble bee*, and which

is so easily distinguished from other bees by its size, and the musical tone of its hum."

"The humble bees," answered I, "are deserving of some attention, although, when compared with our little citizens, the hive bees, they are mere rustics. They form a kind of link between bees and wasps, the hairiness of the body making them more like the former. Like them, too, they live in societies, and collect honey and build cells of wax, and their architecture, though rude and irregular, is very ingenious.

"They build in hedge-rows and meadows, where the soil is entangled by roots of trees, and form the dome of their nest with moss, lined with a thin coating of wax to keep out the wet. The lower part of their nest is scooped out of the ground, and the entrance is in this part, through a gallery which conceals it from observation.

"When the moss roof is removed, a few horizontal combs are seen, placed one upon another, and fastened by small pillars of wax. The combs are oval and of a pale yellow colour; some of the cells, containing the unhatched brood, are closed, others are open. Some round lumps of wax are found at the top of the nest, which contain young larvæ, with a supply of food, made of pollen moistened with



honey. In the corners of the combs, are little waxen goblets filled with the same food, from which the larvæ have escaped.

“ I have just described to you the method in which the carding bees remove the moss with which they build; and it is in exactly the same manner that the humble bees convey the moss for their domes ; thus, like the hive bees, sparing no pains to save their time and labour.

“ The society of humble bees consists of large females, small females, males, and workers. The large females look like giants beside the others, and their duty in the nest is in proportion to their size. The large female builds the cells and fills them with eggs; and, while thus employed, the workers are watching their opportunity to seize and devour the eggs; hence she has the additional task of guarding and protecting them, for many hours after they are laid.

“ The workers, nevertheless, feed the young ; yet it is the female who, as they grow, increases the size of their cells; and afterwards assists them in cutting open the cocoon, in which they are enclosed during the pupa state.

“ The small females likewise lay eggs ; but in other respects they are more like workers, and assist in their various occupations. The queen-

mother is very jealous of her tiny rivals, and always furious when they usurp her office of filling the cells with eggs.

“ Their affection for their young is not exceeded by hive bees ; they spare no trouble nor attention to add to their comforts ; the workers have been known to assemble together in a cold night, and cluster upon a comb full of larvæ, in order to keep it warm.

“ The workers perform the same offices as those in the societies of hive bees. In collecting honey, if they cannot procure it from the open part of the flower, they will make a hole at the bottom of the blossom, and push in their proboscis, to search for the nectar wherever it may be hid.

“ I have heard an amusing anecdote of a party of hive bees going to visit the nest of some humble bees, to beg, borrow, or steal some honey ; and the anecdote is a proof of the good temper of the humble bees. It was in a time of scarcity, and the hive bees not only took possession of what honey they could find, but entered and occupied the nest. Some few humble bees who remained, went out to collect a fresh store, some of which they brought home. The hive bees licked them, presented them their probosces, and, in fact, persuaded

them to give up the contents of their honey-bags; the humble bees then flew off to gather more, and the hive bees parted from them very amicably, never attempting to hurt them with their stings. The population of a nest of humble bees is very small, compared with that of the hive bee; two or three hundred being the usual number."

I was afraid my little party would begin to be wearied with my continued details; but as this was positively the last visit they could pay me previous to the holidays, Letitia begged hard for a few particulars relating to wasps; "since," she said, "I had once hinted that it was in my power to relate something that would give her a more favourable opinion of them."

"Why, Miss Letitia," answered I, "wasps are such notorious depredators, that in attempting to defend them, I shall have many well-grounded prejudices to overcome. However, I will tell you fairly what I know of them; and I must begin by saying, that that is not much; for it is neither a pleasing nor an easy task to make observations about so irritable an insect."

"If the hive bees may be called the skilful citizens, and the humble bees, the rude but honest villagers; the wasps must be considered as thieves and robbers."

“ Wasps hive in societies, and have, like humble bees, two kinds of females, who both lay eggs. The large female wasp, or queen, leads a life of labour; but, in the autumn, can boast of as numerous a family of subjects as even the queen bee herself.

“ The nest of the wasp sometimes contains a population of thirty thousand; and the duty of the workers to the young, begins at their very birth. Their activity in feeding them is quite amusing; they fly from cell to cell, to see what is wanting; and it is to supply the craving of their little ones, that these wasps, who are not able to collect honey out of flowers for themselves, have recourse to the plunder of their neighbours. The fruit he is so fond of stealing, the sugar you grudge him so much, when he disturbs you at breakfast; the ripe peach, or apricot, he conceals himself in, while he is scooping out the ripest morsels,—these are all conveyed with affectionate care to their young; and, gluttons as you call them, are untasted by themselves as long as there is a hungry cry from the cells.

“ The solid food, which they collect from butchers’ meat and other substances, is given to the larger grubs; and as they lay up no store, they have some difficulty in supplying the nume-

rous inhabitants of the nest, when, in autumn, the number amounts to thirty or forty thousand.

“Owing to their improvidence, the wasps are distressed for food when cold weather comes; and on a frosty day, a wasps’ nest presents a scene of horror. The old wasps drag out the grubs from their cells and destroy them, preferring that cruel mode of treatment to the still more cruel one of suffering them to linger on and starve to death by degrees.

“This is a brief history of their short lives, about which I will leave my little moralist, Sarah, to ponder.”

Thus ended my lectures, for which I received the gratifying thanks of my young friends and their governess; who, to my great regret, took leave of me for some time. To me, the parting was melancholy; for they had enlivened my solitude by their sympathy in my favourite studies.

“Farewell,” said Letitia, as she lingered by the garden gate; “I will emulate the bees for their industry, and the bee master for his patience; and I shall ever feel grateful for the sting, which was the means of procuring me so much entertainment.”

## THE HISTORY OF ANTS.

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### CHAPTER I.

SIX weeks passed away; and to me they were weeks of dreary solitude. The occasional visits of my young friends had cheered me, and given an additional interest to my pursuits. They were gone, and were enjoying themselves at their several homes, reaping the fruits of their studies in the approbation of their parents; while I strolled solitarily about my garden, without any interruption, except from old John, with his long stories about the last swarm he had hived.

Wellingford was absent on a short excursion to the continent; and Miss R. and her sisters were all visiting their different friends, or exploring the beautiful scenery of the north.

I am half ashamed to confess, that I felt weary of confining my attention to one species of insects, interesting as I had hitherto found them, and de-

serving of much more persevering observation than I had bestowed upon them.

My thoughts were directed towards ants, whose industry and ingenuity, though not so beneficial to mankind, are equally admirable with those of bees.

“I will study the history of the industrious ant,” said I to myself; “and by the time my young friends return to school, I may have gleaned information that may entice them now and then to renew their visits to my humble cottage.”

And who ever repented *the necessity* of gaining information, whether from want of money or want of occupation? Not, I am sure, the naturalist; his studies, apparently insignificant, are full of interest: they are without expense, they induce him to stroll into the fields, to climb the hills, where the fresh air he breathes gives him health and vigour: they lead him, above all, to admire the order and contrivances of nature, and to adore the Providence which governs even the minute tribes of the insect world.

It is my disposition to be ardent in whatever I undertake: and I set to work to store myself with facts both from nature and from books.

I had got all these tolerably well arranged in my head, when the time approached for the return

of my young friends. Sauntering down towards the village, one morning, I was agreeably surprised to see the gates of the white house thrown open, as if in readiness for approaching carriages. I entered, and perceived a chaise at the door, whose numerous trunks and packages were being conveyed into the inner room by Hannah, more than usually active, from the momentary expectation of fresh arrivals. I retreated through the gate by which I had entered, fearing I might be troublesome, and that I might encounter strangers, of whom I had ever an invincible dread.

I returned to Long Hampton, and, a few days afterwards, despatched a note to Miss R. stating, that if the friends of the hive were willing to study new "Scenes of Industry," I should be happy to introduce them to the *formicary*,\* or habitations of the ants, an industrious society of citizens, almost equally worthy of curiosity and admiration with the bees.

The reply to this note was brought in person, the following Saturday afternoon, when Letitia, Sarah, and two or three others, with Miss R. at their head, again entered my tiny domains, at Long Hampton. Some time was spent in hearty greetings and mutual inquiries; their curiosity to

\* *Formicary*, from the Latin *formica*, an ant.



hear of their friends, the bees, only being equalled by mine to learn all the events of the holidays.

"And you have deserted your bees, and *descended* to the study of ants?"

"I have," replied I; "and I wish you to 'descend' with me; for, I promise you, these little insects will rise rapidly in your estimation. Nor am I discouraged by the contempt you now express for them; remembering, as I do, the antipathy you felt for bees, when first I began to give you a history of them."

"I will promise you one thing, before you begin," said Letitia, "that I shall be delighted to hear what you have to say. And I have no doubt that I shall be much entertained in the new study; but I never shall, or can, take the same interest in, and feel the same affection for ants, which I have done for bees."

"I shall not attempt to contradict you, Letitia," said I; "and I have to thank you for your promise of attention, which is particularly necessary while I go through the *dry* part of my history.

"Ants, like bees, are of the hymenopterous tribe of insects; and, like bees too, their societies consist of three different kinds of individuals, workers, males, and females.

“The workers and females are armed with stings; their antennæ have twelve articulations, or joints. The males have thirteen of these articulations in their antennæ. Ants differ from bees in this respect, the males and females only having wings, the workers none.

“I must again refer you to my little drawings, where you will perceive the figure of an ant. Its head is triangular, pointed at the end; its two teeth, called *mandibles*, are placed at the termination, and the mouth is beneath. Its large eyes are placed on each side, with three small ones above, which form a triangle. The antennæ are situated in the fore part of the head; the palpi, or feelers, are under the lower jaws.

“The mandibles of the workers and females are horny, curved, and moveable, and adapted to serve many useful purposes; those of the male are soft, and covered with fine hair.

“It has been supposed, that ants have no tongue; but I have observed, that when they drink, they project from their lower jaws a tiny yellow tube, which alternately advances and retires; and I have no doubt that this performs the office of a tongue for them.

“The head of the ant is joined to its body by a thin short neck; and the corselet, or body, con-

sists of several horny pieces, in the middle of which are placed four wings. These are large and transparent. They have six legs, and at the extremity of each, a spine, or spur. The foot, or tarsus, is covered with a fringe-work of strong hair, cut regularly ; and with this brush the insect cleans its antennæ, head, and body.

“The workers are much smaller than the females, from whom they differ in having no sting, nor any wings ; as well as in the shape and colour of their bodies.

“After this general description of ants, I shall carry you to their habitations, of which there is an infinitely greater variety than among the bees. The ant-hills, those mounds of earth, which you would hardly believe to be raised by such little workpeople, is one species of architecture among them. Sometimes they form their houses of leaves and stalks ; and sometimes they build them in the trunks of the most solid trees.

“And now you must accompany me to the ant-hills, which are so plentiful in my favourite wood on the top of yonder hill ; that wood from which I first saw my little friends, when the unlucky accident of the bees’ nest took place.”

“Unlucky !” exclaimed Letitia ; “I have long since learned to consider it as one of the most

fortunate circumstances of my life—of my school life, at least,” added she, as she perceived an incredulous smile on my countenance.

We continued chatting till we reached the firs which formed the wood; and at the foot of these trees, the ant-hills spread in every direction.

“The kind of ant which forms these mounds is called the *fallow\** ant, from its colour, which is of a pale red. There are two varieties of the fallow ant; one of which has a black mark on its back, and the other has a back of the same colour as its corselet, or body.

“The only difference between the two is, that those with the black backs build in meadows and hedge-rows, instead of woods: they all collect the same materials for building: leaves, bits of wood and straw, stones, &c.; every thing, in fact, that can add to the height of the building, not excepting small shells, barley, oats, and corn: the three latter used to be considered as stored up for winter use; but it is now discovered that they are collected merely for the purposes of architecture.”

LETITIA. “But what can be the use of this *magnificent* structure, if they do not want the room to lay up winter stores? Surely, a smaller house would be more suitable for these little crea-

\* *Fallow*, from the Saxon *folewe*, pale red.

tures. I am afraid we shall have to convict them of pride !”

“ The pride of ingenuity they might feel, Letitia, as you will presently acknowledge. We are all apt to judge superficially of the actions of others ; and, surely, you are not competent to speak, till you have seen something more than the outside of the dwelling-place of ants.

“ The mound, which appears an useless mass of rubbish heaped together, is an invention, equally simple and clever, for the purposes of carrying off the water from the ant-hill, and protecting its inmates from the attacks of enemies, and the injuries of the weather.

“ The base of this dome is built of pebbles, so as to form a cone ; above which, the wooden part of the building is in the shape of a sugar-loaf ; and the whole is finished up with soil.

“ This is merely the outside covering of the ant-hill ; crooked, funnel-shaped avenues branch underneath, leading from the roof to the interior, which is by far the greater portion of the establishment. The entrance is sometimes formed by a large opening at top ; sometimes by a number of small holes, surrounded by narrow passages, which extend to the very bottom of the dome. These numerous passages are necessary for the

ants, who always prefer working in the open air, and are, therefore, constantly passing in and out. Such numbers are always collected together on the outside of the mound, that they do not fear the approach of enemies, although their habitation is thus exposed."

LETITIA. "But, when night comes, do not they retire within? And is not their house then exposed not only to enemies, but to rain and cold air?"

"These questions are very natural; and it is a subject that has engaged much of my attention; for, if this were the case, the prudence and instinct of ants would seem in this instance to fail them.

"Many and many an hour's watching, and many a walk, both night and morning, has this engaged me in; and, at length, I made a grand discovery. I observed that these apertures changed their appearance every hour; and that, as night approached, these spacious passages, which admitted so many ants during the day, gradually became less, and at length quite disappeared; the ants retired within to rest, and the dome was closed on all sides."

"I own," cried Letitia, "you have excited my admiration as well as my curiosity! Were you able to perceive how they accomplish this?"

“ Indeed, I never rested till I made it out. At first, I could distinguish nothing, from the confusion of the scene, with so many thousands of ants moving upon the mound; but after patient observation, and that, you know, Letitia, overcomes every difficulty, I found out what they were about.

“ I perceived them bring little bits of wood to the entrances of the various avenues; these they placed above the apertures, and often sunk them into the stubble; then they went to fetch something else, which they placed upon the first row, each succeeding piece being smaller and smaller. With dried leaves and other larger kind of materials, they then covered the roof, and gradually retired within; one or two remaining after the last passages were closed, who either remained without; or were concealed behind the doors, while the rest pursued their occupations or indulged in repose.”

SARAH. “ Quite masons in miniature, I declare! Were you ever in time to observe the opening of the city gates in a morning?”

“ I have seen it over and over again, till my curiosity had thoroughly satisfied itself. I visited these ant-hills quite early in the morning, and saw, at first, only one or two solitary guards; by

degrees, a few others crept from beneath the edges of the little roofs, slanting over the entrances of the openings. Other ants then came forth, the wooden bars were by degrees removed, though by the labour of some hours. At length, the passages were all open, and the materials with which they had been closed, were scattered about the mound.

“ Nor does their sagacity cease here ; for if the morning prove rainy, the ants never open their avenues. When the sky is cloudy, they are opened in part, and instantly shut when the rain begins. Thus, they are not only gifted with instinct to act, but it would seem, also, as if they were conscious *why* they were thus acting.

“ I wish you had been my companions when I witnessed the whole process of the construction of an ant-hill, from the time that it was merely a hole in the earth.

“ Some few set to work to search for materials suitable for the construction of the exterior, and began the work by fitting up the entrance. Others were employed in mixing the soil which had been thrown out of the hollow, with the leaves and bits of wood collected by their brother labourers. With this they formed a solid foundation for their dome, which increased every day.



“ Here and there, they left cavities for the galleries, they intended to construct, leading to the outside. These passages were entire throughout the whole process. The building gradually assumed the form of a dome; but it was far from solid. This roof, in fact, contains many apartments.

“ By digging or mining within it, they form their spacious halls, which, though low and clumsy, are well suited for receiving the larvæ and pupæ.

“ There are galleries, which lead from one hall to another, and they are made in the same manner. To enable them to form a neater building than they could do with soil and their other materials alone, they mix them up with rain water, which, hardening in the sun, binds and forms a compact wall, parts of which may be taken away, and replaced, without injuring the rest. It serves, too, as a preservative against damp; for I have never found that even the hardest rain penetrated above a quarter of an inch into the nest, unless it were out of repair, or had been deserted by its inhabitants.

“ The largest chamber is in the centre of the nest; it is higher than the rest, and crossed only by the beams which form its ceiling. All the

galleries terminate in this chamber, which is their usual place of abode.

“Of this part of the building, I can speak with certainty; for I placed a pane of glass to one of their apertures, which enabled me to take a very good view of the interior.

“The part under ground is not so easy to be viewed; indeed, it can only be observed when placed by the side of a hill. By then raising the straw roof, the whole may be seen. As this part of the architecture of the fallow ants is similar to that of the mason ants, I shall give you an account of them both together.

“The *mason ants* are those whose habitations look like hillocks of earth, without the mixture of any other materials, and whose interior consists of labyrinths, lodges, vaults, and galleries innumerable, all constructed with great ingenuity.

“The brown, the yellow, and the microscopic ants, are all species of the mason ants. The brown ant is one of the smallest, and is distinguished by the beautiful finish of its work. Its body is of a shining red-brown, the head is a little deeper in colour, and its antennæ and feet are rather lighter. Of all the tribes of ants, this is the most industrious. It forms its nest in stories, the partitions between which are very thin; and the

substance of which they are composed is so finely grained, that it presents a smooth unpolished surface.

The stories are all sloped, to correspond with the dome of the nest, and are placed one upon another to the ground-floor, which leads into the subterranean passages. There is no great regularity observed in these buildings, the plan of which they vary and alter as much as they please. In each story, there are halls, lodges of narrower dimensions, and galleries of general communication. The largest halls have arched ceilings, supported by little pillars, or thin walls. There are chambers, too, which have only one entrance leading into the lower story; and there are likewise open spaces, forming a cross-road, in which all the other roads terminate.

I have ever found, on opening one of these curious nests, that the lower apartments and open spaces were filled with the older ants; while the larvæ and pupæ were kept in the apartments nearer the surface. This, however, depends upon the weather, the young ones requiring a certain degree of warmth.

“ Would you believe, that an ant-hill, such as I have been describing to you, consists of upwards

of twenty stories above, and twenty below the surface of the ground ?

“ The heat of the different apartments varies ; and when the sun is very powerful upon the upper rooms, the young are removed into those at the bottom. The rainy season, on the contrary, renders the lower apartments damp and cold, and then the upper stories are inhabited by both old ants and their young.”

LETITIA. “ How astonishing, that, with their little delicate teeth, these ants can work up the soil so as to make walls and build houses so many stories high !”

“ True, Letitia ; and to me it was for a long time a puzzle how they moistened the soil, in order to render it sufficiently soft and flexible for their purpose, and yet that it should be so solid. Is it, thought I, a fluid furnished by the ants themselves, similar to that which the mason bees employ ? I took particular notice of an ant-hill, of a round form, in the grass close by the pathway. It was perfect ; not having sustained any injury. I saw no ants, or very few, come out all through the day : they were terrified by the heat of the sun’s rays, which they cannot stand. Towards evening, when the air was cool, and

there was dew upon the grass, they began to make new apertures, put out their antennæ, and at length ventured upon the grass.

“ I remembered the opinion of some of the ancient naturalists, that ants build their houses in the moonlight, when the moon is at its full. This notion is, doubtless, fanciful ; but I certainly perceived, that, contrary to the practice of the fallow ants, who are out in the day time, and shut up during night, the brown ants always worked after sunset.

“ Another difference between them and the fallow ants was, that they worked during a shower of rain : this I frequently observed ; for often and often have I seen them, as soon as it began to rain, leave their subterraneous dwelling, and return to it almost immediately, carrying between their teeth little pellets of earth, which they put down upon the roof of their nest. I was doubtful what this could be for, till I saw that little walls were starting up on every side, with spaces between them. Pillars ranged between them, shewed me that they were laying a foundation for a story, with halls, lodges, and passages. Each ant collected a little pellet of earth, which it scraped up with its mandibles from the bottom of its house. This little heap could easily be moulded into the form

they wished ; and when they had placed it upon the spot on which it was to remain, they worked it up with their teeth to make it even. Then they passed their antennæ over it, to give it a finish, and put each particle in its proper place. By the help of the fore feet, with which they pressed it lightly, the whole was then made compact.

“ With the greatest speed, they proceeded in this work, and went over it again, adding to it where materials were wanting, and laying foundations for pillars and galleries. When the whole was of a certain height, they covered it in by an arched ceiling.

“ They then left this part of their work, and, fixing to the inside and upper part of the wall, fragments of moistened earth horizontally, they formed a ledge, which would exactly meet another proceeding from the opposite wall.

“ In some parts of the nest, the scaffolding for a lodge might be seen ; in others, a finished hall, with its roof supported by pillars.

“ I cannot say when I have been more interested than in seeing this busy troop of masons, arriving with their pellets one after another in admirable order ; and preserving perfect harmony, united with the greatest eagerness to use the rainy hour in adding to the height of their building.

“ The firmness of these buildings surprised me exceedingly ; for, I own, I was constantly expecting that the rain, which incessantly fell upon them, would force them to give way. But I was mistaken : there was great stability in all their works, which the rain seemed to increase rather than diminish.

“ A shower of rain seems in fact necessary to complete the work, and to varnish over those places where the galleries remain uncovered. All the inequalities of the architecture then vanish, the roofs of the stories, formed of a variety of pieces, look like one smooth surface. The heat of the sun, coming afterwards, hardens and finishes the building.

“ Each story was completed in the course of seven or eight hours ; and as soon as one was finished, the indefatigable ants began another. When the rain ceased, they were forced to stop ; a sharp north wind so dried up their walls, that many of them fell to powder ; and the ants, in despair, abandoned their employment, and actually pulled to pieces and destroyed all the apartments that remained uncovered, and scattered the materials.

“ Since rain is so essential to these industrious little masons, it is natural they should choose spring as the best season for building, in conse-

quence of the gentle showers, which are then frequent. It is for the works they raise above ground that they need the materials they collect; and their art consists in the double operation of building and mining at the same time, the soil they throw up from the one, being used in the other part of their labours.

“Before I conclude my account of the labours of the brown ants, I must tell you that they frequently construct galleries, which lead from their nests to the feet of trees at some distance, in order to reach their food with greater security.

“Among the number of mason ants may be reckoned the dark ash-coloured, with red antennæ and feet.

“The architecture of this ash-coloured ant is of a more simple and heavy kind than that of the brown ant. Its hillock is formed of thick walls, made of coarse earth; the stories are clearly marked out; and the rooms are large, with vaulted roofs. Instead of galleries, they have wide passages, of an oval form, surrounded by embankments of earth. The pillars of their rooms are large, in proportion to the arched ceilings they have to support.

“They have none of the nicety or finish about their works, which the brown ants have. The very simplicity in their buildings has enabled me



to make closer observations of them than I have been able to do of the brown and fallow ants.

“ I have felt a strong curiosity to find out whether ants act in concert one with another ; or if each ant determined for itself what it should set about ; and I am inclined to believe the latter.

“ The quickness with which they seize any favourable opportunity for beginning their work is astonishing. An ant discovers upon the nest two straws placed cross-wise, and it strikes him it would be a good beginning of a lodge. He examines it all round, places parcels of earth up the sides of the stalks to fill up the spaces, and so intent is this little creature upon his plan, that he does not hesitate to destroy the labours of other ants in his eagerness to collect materials. He goes, returns, and continues his building, until he has done sufficient to make his plan apparent to his companions, who then go on with the work.

“ I have likewise seen several pieces of straw so thrown together, as if on purpose to form the roof of a story : I have seen an ant approach it, and, struck with its suitableness, set to work upon it, and, plastering the sides of the straw with earth, form the beams for the ceiling ; then, placing several rows of the same materials one beside the other, the roof became distinctly marked out,

and other workmen joined the original founder in completing his work.

“ When they wish to enlarge the boundaries of their hill, they search the neighbourhood, and, generally, are able to find blades of grass or stalks of corn growing upright, which seem exactly suited for pillars ; and these industrious little creatures set instantly to work to plaster up the sides with earth, which they do in the neatest manner, making them solid by repeatedly adding a fresh layer. They then leave them to be hardened by the wind, and afterwards, by throwing arches from pillar to pillar, form an extensive range. When they want smaller rooms, they have only to add fresh clay between the pillars all the way up to the roof ; and, by leaving small openings every now and then, they gain their object.”

I now paused, somewhat surprised to find that the minute details I had been entering upon, of the mode of building of the fallow and mason ants, had taken up so much time that the shades of evening were absolutely stealing upon us. My attentive auditors had seated themselves on some dry turf around the fir trees, and appeared, like myself, to have forgotten all but the interest of the subject.

When I stopped, however, they started up ; and

Miss R. laughingly declared, that, since I had thus detained them, I could do nothing less than see them safe home.

What is more agreeable than to be told to do what one wishes to do? In high good-humour, therefore, I sauntered down the hill, in conversation sedate but pleasing; while Letitia and her juvenile companions, weary of their long silence, were frolicking about, laughing and talking in their merriest mood.

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## CHAPTER II.

HAVING agreed, before we parted, to meet on the following afternoon at the wood on the hill, I resumed my lecture at the time and place appointed.

“ I have given you an ample account of the architecture of the fallow ants, and of some species of the mason ants: I now proceed to describe that of the *timber ants*, or those who inhabit trees. There are several different kinds even of this ant; I shall begin with the *fuliginous*,\* so called from its shining black colour. Their republics are com-

\* *Fuliginous*, from the Latin *fuligo*, smoke.

posed of a numerous race; but they are less frequently met with than the ants I have before mentioned.

“To form an idea of their cities, bored or hollowed out in the trunk of a tree, is no very easy matter. They consist of numberless horizontal stories, whose ceilings, as thin as a card, are supported, sometimes by upright partitions, so as to form a number of cells, sometimes by a set of slender pillars, between which you may see to the very end of the story. The whole is composed of blackish smokey-looking wood. You must behold the numerous lodges, halls, and passages, to form an idea of these little beings, and to judge of the effects of persevering labour.”

LETITIA. “The wood they build with is blackish, you say. How is that? Have they the art of painting, in addition to their skill in carpenters’ work?”

“I am obliged, Letitia, to confess my ignorance on that point, in common with other naturalists. Whatever trees this ant bores in, the oak, the willow, &c. the wood always becomes of this blackish colour, with which the cells are stained, not only on the outside, but all through, if the walls be thin. There are other species of ants, who build in trees; but only the fuliginous produce this effect. I

have even noticed at the foot of trees inhabited by them, a quantity of blackish liquor. The vegetation of the tree does not appear to be injured by the ants boring in it. The fact is, we cannot have our curiosity gratified by observing the labours of these ants as they go on; otherwise, we should soon discover the origin of this black tint; but how is it possible to see these little things, who anxiously screen themselves from notice in the interior of a tree? I have tried many times, and endeavoured to coax them to construct their habitation where I could inspect them; but, notwithstanding my sugar and honey, they abandoned the nest I had given them, to seek for another more retired.

“ I was obliged therefore to take a piece of their nest to pieces, and to rest satisfied with admiring the delicacy and lightness of their thin partitions, and their double rows of horizontal galleries, which correspond to the circular form of the layers of wood.

“ The stories which spread downwards into the thick roots, are not constructed with the same regularity as those in the trunk, probably owing to the wood being more fibrous and knotty; but they still continue to be horizontal, and intersected with numerous partitions; and in proportion as

the wood is harder, their work is more delicate, and often arrives at an extreme degree of lightness. I have seen pieces, from eight to ten inches in breadth and height, formed of wood as thin as paper, containing a number of rooms: the appearance is truly singular. The entrance to these apartments, hewn out with so much labour, are very wide; and, instead of chambers and extensive galleries, the layers of wood are bored in arcades, through which the ants can have a ready passage to every part of the nest.

“The *red ant*, another species of timber ant, and rather larger than the last, builds, like them, in trees, but on a smaller scale. They, too, form stories, which are divided into small chambers, or lodges, with very thin divisions. The wood is not blackened, and is not harder than a cork.

“The most curious circumstance relating to red ants is, that they are skilful masons as well as carvers, and often make their nests in the earth.

“They are not, however, the only ants which display a double talent; and I must leave them, to introduce you to the Ethiopian and the yellow ants, who have a talent peculiar to themselves.

“The *Ethiopian ant* is so called, from its jet black colour; it makes its long galleries and lodges in the trunks of the oldest trees; and the singula-

rity attending the industry of these ants is, that they use the wood which has fallen to powder at the bottom of the tree, to stop up every hole in the floors of their houses, and to close useless passages.

“ The *yellow ant* displays still greater industry in constructing whole stories with decayed wood, choosing the smallest particles, and mixing them up at the bottom of the tree with a little earth and spiders’ web, until they form a substance as consistent as the *papier maché* of which teaboards are made.

“ These are the most striking facts relating to the architectural skill of ants; there are, indeed, many others, almost equally singular; but I am fearful of hearing complaints of fatigue from my young friends. There are *field ants*, who build little chambers one above the other, along the stems of plants, and who, if they require it, can connect together grains of sand with merely the assistance of a little moistened earth. There is the *sanguine ant*, who, with dry leaves, earth, and some other materials, forms a wall, difficult to break, and through which no water can penetrate.

“ In New South Wales, there are ants which build their nests entirely of the leaves of trees. Several of these, each as large as my hand, are glued together; and, to keep them in a proper

position, thousands of ants unite their strength; for, if driven away before they have accomplished their design, the leaves spring back violently.

“There is an ant, met with in Cayenne, which builds its nest of down, collected from the seeds of a species of cotton-tree: and in Tobago, there is a sort, called the *parasol ant*, which cuts round pieces out of the leaves of trees and plants, and conveys them to the nest: while thus occupied, the ants bear some resemblance to persons carrying umbrellas, or parasols; from which they take their name.

“As I have been anxious to collect as many facts as possible, relating to these extraordinary little insects, I must not omit what I have met with concerning the *termites*,\* called by travellers, *white ants*. They are abundant in Africa; and may justly be termed a species of mason-ants. Their habitations, indeed, are extraordinary, compared to the size of the insect which builds them. Some of their buildings are more than twelve feet in height; and so firm as to bear the pressure of several men upon them.

“They station sentinels to watch the wild cattle, which are quietly grazing below, in order to bring

\* *Termites*, from the Latin *termes*, a little worm that feeds on wood.



them the first notice of danger. They begin their city, by building little turrets of clay at short distances from each other, of the shape of sugar-loaves. On the tops of these, they build others : those in the middle being the highest. The spaces between are then covered, and the inner turrets taken down, leaving what forms the cupola, or dome. The clay thus saved, they make use of in building chambers : the nurseries are of wood, enclosed in these chambers of clay, and ranged as close as possible around the royal cell. This apartment is, like the others, arched over, and situated in the centre of the building. At first, it is made small, but is increased as the queen increases in size. The queen, before she begins to lay her eggs, is equal in size to twenty thousand labourers ; and she lays as many as eighty thousand eggs in the course of four-and-twenty hours.

“ Of course, the number of cells must be immense. The subterraneous passages wind about in a spiral direction ; for the ascent would be otherwise too steep : to shorten, indeed, the distance to the upper nurseries, into which they have to carry the eggs, they throw up an arch with steps, which shortens the passage.

“ When they go upon their pilfering expeditions, which are highly dreaded in the neighbour-

hood, they construct covered galleries of clay, which run to a considerable distance, and under which they can go and return in safety.

“ Having thus given you an insight into the habitations of the ant, I *vote* that we should stroll down the hill to my cottage; for I shall have again to call in the assistance of my little sketches. As we go along, I must remind you of the metamorphoses which all insects undergo, and which, I hope, some of my party have not forgotten.”

“ None of us, I hope,” said Letitia; “ the egg, the larva, the pupa, and the imago, are the four different states of an insect.”

“ Right, my young friend,” answered I. “ We must begin with the egg; but I must first of all acquaint you, that these insects, which we have seen exposing themselves to damp, and cold, and every danger, shew the greatest anxiety and tenderness for their little ones, who are so delicately formed, that the least breath of cold air would endanger their lives. For this reason, they are carefully concealed from observation; nor is light even allowed to penetrate their abode.

“ You will scarcely believe the difficulty I have had in watching the conduct of the ants in the interior of their nests, and their ingenuity in baffling all my attempts to introduce light into

them. Whenever I placed a pane of glass against their cells, so as to enable me to see into them, they either abandoned their works, or prevented me from benefitting by mine. One time, they would heap up materials, so as to darken all their walls; another time, they seemed to discover that my glass pane would make an excellent wall, but as its transparency was an inconvenience to them, they plastered it over with moistened earth, so that it was no longer transparent.

“I tried another plan; I took away a portion of an ant-hill, and placed against the remainder a thin board inclining to the south. The warmth attracted the ants, who brought their little ones to it. By removing this board, I was able to observe the growth of the young ones; though, as soon as they were disturbed, the workers hastened to convey them underground out of sight.

“As soon as the ants found out this plan of mine, they built a real wall of earth behind the wooden board; and I was obliged to vary my schemes. After great perseverance, accompanied with great caution, I accustomed them by degrees to suffer a little light to enter their abode; and made a kind of frame, fixed to a table, two sides of which were glazed and covered with shutters.

“Into this frame I turned a nest of fallow ants;

who, liking the situation, soon began to build, and by removing occasionally the shutters, I could watch their progress, and observe the care they took of their young."

By this time, we had reached my cottage-garden, where an agreeable surprise awaited my little friends. We entered the well-known arbour, now no longer pink with hawthorn blossom, but brown and musty, half leafless, in fact. The inside, however, had been decorated, by John's active exertions, with such flowers as the season afforded; dahlias and chrysanthemums, in the midst of which, instead of a hive, stood a table, supporting the frame I had just described.

I removed the shutter : " See," I cried, " what is passing within ; here the pupæ are heaped up in their lodges by hundreds ; there the larvæ are collected and guarded by the workers. You may see here a bundle of eggs ; and you may perceive, too, a party of workers, in attendance upon an ant of larger size, whom they follow every where. This is the queen-mother, or one of them rather ; for ants, unlike the bees, have several in each colony.

" See how she walks ; laying her eggs as she goes on. Her attendants take up the eggs, or seize them the very moment they are laid ; they

collect them together, and carry them in little heaps in their mouths."

LETITIA. "How very, very small they are! surely they must have some contrivance to fasten them together, to enable the ants to carry them in their mandibles."

"Probably they have some contrivance, some glutinous liquid, by which they hold them; you observe, they turn them with their tongues, and pass them one after the other between their teeth, and thus keep them moistened.

"These eggs are too minute for us to distinguish at present; but, when closely examined, are found to be of different sizes, forms, and colours; the smallest are white and opake, the largest transparent, and those of the middle size semi-transparent. In some, which are very clear, a ring is perceptible, and it is at this part that the egg opens, and from it the larva makes its appearance. I suppose, that the moisture afforded to the eggs by the workers, as they pass them across their mouths, is necessary for their existence; for I have never been able to preserve any eggs that I have removed; they always dried up before they were hatched.

"In fifteen days, the larva, or little worm, quits its shell; its body is transparent, and consists

merely of a head and rings ; no appearance of feet and antennæ are visible. These larvæ are dependent upon the workers, who take the greatest care of them, as I have before told you. A body of ants guard them, who, raised upon their feet, stand prepared to sting any approaching enemy ; another set of workers clear the passages, and remove any materials that might be out of place. Other workers are seen taking their repose, to all appearance fast asleep ; but a busy scene presents itself, when the sun's warmth makes them think it desirable to transport their little ones to enjoy it. The ants from the outside rapidly descend within, striking with their antennæ all the ants they meet on the way ; they run after each other, jostle their companions, who at the same time ascend into the frame, and then return to add to the general confusion, until all the passages become filled up with swarms of workers.

“The object of all the ants, as soon as they became aware of the sun's appearance, seemed to be to carry up the larvæ and pupæ to the top of the ant-hill, and to leave them there to feel the influence of the heat. Their labours were unceasing ; the female larvæ, which were heavier than the others, were carried with much difficulty through the narrow passages leading from the

bottom to the top of the hill. After they had been there for about a quarter of an hour, the workers again removed them, lest the heat should be too powerful, and placed them in chambers, under a ceiling of straw, which only in part intercepted the heat.

“Then did these little beings, after having performed their duty to their young, think of themselves, and stretching themselves in heaps in the sun seemed to enjoy repose. This, however, did not last long; and, as the sun declined, they by degrees carried back the larvæ.

“When the time for feeding the larvæ was arrived, each ant came to a larva and offered it food.”

MISS R. “There is nothing, I think, more wonderful in nature than the metamorphoses of insects; that this little shapeless, helpless worm, should afterwards become a nimble, industrious, and enterprising ant!”

“They would, indeed, be incredible, if we were not daily witnesses of them,” said I. “Who would believe that the beautiful butterfly, proudly unfolding its radiant wings to the sun, was ever a creeping caterpillar? That beautiful silver-winged fly, which we see before us, was originally a water insect; and that little creature, which lives

but a few hours as a winged insect, belonged at first to the same element. The gnat, so great an enemy to us all, was once an inhabitant of a stagnant pool; and the beetle, that flits along at even, was shut up as a worm amidst rocks and stones for a long time. Thousands of instances could I enumerate—but I forget my subject!—Let us return to our ants.

“The little worms, or larvæ, have instinct enough to ask for their food, and receive it as young birds do from their parents. They raise their body, and search for the mouth of the appointed worker, who then opens its mandibles, and allows the young to suck the fluid out of its mouth.

“This food is probably of a sweet nature, and is given to the different larvæ in quantities proportioned to their age and sex.

“The next care, after feeding the larvæ, is to keep them clean, which the workers do by passing their tongue and mandibles constantly over their bodies, which they keep perfectly white. I could never be weary of witnessing the affectionate care, and constant attention shewn by the ants to their young; in which I am certain that they are exceeded by no creature whatever.

“Most of the larvæ spin a cocoon, similar to



that of the bees; but it is a singular fact, that some larvæ never spin.

“ In some species of ants, the larvæ are heaped up in the lowermost room of the nest, and pass the winter there ; this is the case with the yellow and the field ants ; but never with the fallow, the ash-coloured, or the mining ants. Those which pass the winter in this state are covered with hair ; but none of the others are so.

“ In the beginning of summer, the insect is transformed into its third, or pupa state ; it is a perfect ant, except that it wants firmness and strength. After a few moments, it becomes motionless ; then it gradually changes its colour from white to pale yellow, then to red, or brown, or black, according to its species. Even in this state, they are dependent upon the workers ; for they cannot extricate themselves from the web they have spun in their larva state ; and the labourers, though not at all related to them, shew a zeal and attachment in performing this office for them, which we should admire, if they were their real parents. I have seen two or three males and females in their cocoons, in one of the largest cavities of my frame. I observed a number of labourers assembled around them, in constant motion : three or four mounted upon a cocoon, to open it with

their teeth, at the part near the head; these tore away some of the silken threads, in order to thin it, and by dint of biting and pinching, they made a number of holes in it: they afterwards tried to increase these holes by tearing away more silk; but, not succeeding, they put one of their teeth into a hole, and cutting each thread, one after another, with great patience, made themselves a passage through a part of the web. They then uncovered the feet and head of the insect; but, finding a larger opening necessary, they cut on with their teeth, just as you would cut with your scissors.

“While this was going on, there was great agitation in the nest; and several workers succeeded one another in the employment: nor were their labours ended when the pupa was extricated: there still remained another kind of satin-like skin, which covered the whole insect. When this was removed, it had every part perfectly displayed—antennæ, wings, and feet, and could walk and receive nourishment, of which last alone it now stood in need.

“On every part of the hill, were the ants thus employed; and they are most orderly creatures; they collected the shreds of the cocoons, and carried them into their most distant lodges. Some kinds

of ants remove them to a distance from the nest, while others cover their nest with them, or collect them into one apartment.

“ The education of the young ants then commences: the workers watch and follow them, go with them in their excursions, teach them the various paths and labyrinths of their habitation. They have another and difficult task, too, in unfolding the wings of the males and females, which would otherwise remain always folded; and this they perform so delicately as not to injure the tender members.

“ And here I take my leave for this evening of the industrious ant, for whom I cannot doubt but my young friends already feel more admiration than they at first expected.”

The whole group readily acknowledged this; and, well pleased with each other, as well as with our subject, we separated, after a promise from them of another visit soon.

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### CHAPTER III.

“ WE must take leave for the present,” said I, at our next meeting, “ of my glazed ant-hill, and

take a walk down to the river, to survey the mounds which rise all along the meadow by its side."

We reached the meadow, and were fortunate enough to find an ant-hill in the state I had wished.

"We have seen the interior of the nest of these singular little beings; now tell me what you see on the exterior."

"I see," cried Letitia, "thousands of ants, with glittering wings, walking about the hill."

"These are the males and females of the field ants; you may trace them, too, climbing every plant in the neighbourhood of their habitation. The workers follow them like humble attendants; some escort them merely, while some follow and attempt to bring them back to the hill. The male ants display their brilliant wings as they come forth by hundreds from their subterranean dwelling; while the females, though much larger, are fewer in number."

"This is a very pretty sight!" cried Sarah.

"What variety in the colours of the insects!"

"Some are all of one colour; the workers yellow, the males black, and the females flaxen," said I; "yet their wings have all the beautiful hues of the rainbow: others are varied; the body of the workers is ash-coloured, stained with red; the

males, with black bodies, have yellow feet, and white wings; the females have brown bodies, with orange spots. But see what an agitation is spread over the ant-hill. The little workers run from one of their winged brethren to another, touching them with their antennæ, and offering them food. At length the males and females fly off, and the workers return alone to the nest, and close the entrances.

“ This swarming of the winged part of the community takes place in a warm summer morning, and is frequent even so late in the year as September.

“ Ants have not, like bees, the power of finding their own nests, and of returning to them. After once leaving them, they never return: the males die an early death, the duration of their life probably not exceeding a few weeks.

“ The females, when they come again to the ground, strip themselves of their wings with their antennæ. They wander up and down for some time in search of a nest; and, at length, finding a suitable place, deposit their eggs, and perform all the duties to the young which are usually performed by the workers.

“ All the winged females, however, do not leave the nest; some are retained prisoners by the

workers, whose instinct teaches them that they are necessary to the community ; and some remain voluntarily. These are all attended by the workers, who guard them closely until they begin to lay their eggs ; a single ant then accompanies each, and provides her with whatever she needs. This sentinel seizes the first egg she lays, and carries it off to a cell, another worker succeeding to her post. As the female continues laying, the ants begin to treat her with the same homage as the bees pay to their queen ; ten or fifteen wait upon her, offer her food, and lead her through the narrow passages of the nest. When she wishes to rest, a party of ants surround her.

“ Many females, I have before told you, live in one nest ; no rivalry is shewn by one to another : each has her court ; and though they have no real power, for that belongs to the indefatigable workers, they have great honour and affection shewn them. I have seen a queen-ant enter one of the apartments, and joy and exultation has spread itself all through it. The workers prance and skip and frolic about, as if congratulating themselves with the presence of their queen. Some walk over her, others dance round her, while all cluster about and encircle her.

“ We have now,” continued I, “ made all the

observations we can from the ant-hill itself; and the damps of an autumnal evening, though they may not affect young and healthy damsels, like yourselves, are not to be despised by a rheumatic man, as I am. Let us return to the sofa of my parlour; and, after my lecture, I will regale you with some of Kitty's mead, of which she is not a little proud."

Letitia rather pertly remarked, "that she was glad Kitty had not forgotten the bees, although her master had slighted them of late."

"Are not my visits to the formicary as much for your benefit as mine, Miss Letitia?" answered I. "I doubt, if you would be entirely satisfied now, if you were to hear no more of these new acquaintance of mine and your's."

"No, indeed, I should not," answered Letitia; "you have introduced us to the different individuals, the winged males and females, and the wingless industrious labourers, but of their relation one to another I have yet to learn."

"I have some curious facts on this subject, well worthy your attention," answered I. "I told you how the nests are guarded at night: these faithful watchmen are not wanting in courage; and, when attacked, are ever ready to defend themselves bravely. Some, however, always steal down into

the interior of the nest with news of the danger. The alarm spreads throughout the city, and bands of labourers crowd to the assistance of their brethren, full of alarm and uneasiness. What is worthy, too, of our admiration, is the conduct of those labourers who are destined to take care of the young, and who, in the first moments of alarm, convey their charge to the very bottom of the nest, and deposit them in safety.

“To learn in what manner the alarm was communicated from one to another, I was forced to watch a society of Herculean ants, which are much larger than common ants, and live in the hollows of trees, which they never leave until the spring. I watched them, then, and disturbed the ants who were at the greatest distance from their companions, by blowing upon them. Immediately I saw these run to the others and give them gentle blows upon the body with their heads; and, by thus communicating their fear or anger, the alarm became general, and they all ran to and fro in great confusion.

“Ants make excursions in bodies; and it is curious to observe how they are able to follow each other's steps from place to place.

“M. Bonnet, a celebrated naturalist, thought it



was by smell that they followed the same track ; but I am of opinion that they actually fetch one another. I have amused myself with putting pieces of nests in my room, and watching when and where the ants, thus dispersed, would unite again. They set out a thousand different ways, without any clue to guide them, till at length, one of them accidentally discovered a chink in the flooring, which led into a darkened cavity. I traced this very ant returning to its companions, and, by particular movements of its antennæ, imparting the joyful news. It even led the way to the entrance for some, who, in their turn, returned and served as guides for more ants. By degrees, all received intimation, by having had their antennæ struck ; and the whole party of ants were soon safely lodged in the hole of the floor."

MISS R. " I remember a story of Dr. Franklin, who discovered a number of ants feasting upon some treacle in one of his cupboards. He put the whole army to flight, as he supposed, and hung up the treacle-pot by a string to the ceiling, but what was his astonishment to see one single ant steal from the treacle-pot, climb up the string to the ceiling, and reach its nest. In a very short time, many of the other ants set out to ac-

company him ; these crossed the ceiling, and, descending the string feasted upon the treacle, which they continued to visit till it was all consumed."

"All ants, however, do not communicate by means of the antennæ. I am now going to tell you of the migrations of ants, who are occasionally induced to quit their old abode, and establish themselves in a fresh one. Ants are induced thus to remove their habitation, by finding their former one either damp, or exposed to the attack of an enemy ; and their manner of doing it is so singular, that I am induced to give you a complete history of it.

"What do you think, for instance, of ants carrying each other?"

LETITIA. "How droll ! Surely if one ant is able to take a journey, the others would be equally capable of doing so !"

"What," answered I, "do you think yourself, Miss Letitia, equally capable with me of bearing a long journey ? If we were to set out to walk together for many miles, I fancy you would be glad enough to make use of my shoulders, before I should even think of being tired. But, whatever be their motive ; whether the age, the sickness, or the infancy of their companions, it is true that a part of the community carries the rest.

“ I have seen them remove their habitation ; and have seen, about half-a-dozen yards from their old one, a new ant-hill start up, communicating with the other, by a path across the grass, along which the ants were passing and repassing in great numbers. All those who were going to the new ant-hill, were loaded with their companions ; and all those returning to the old one, were running one after another, no doubt, to convey some more.

“ I have made this experiment, by driving ants from their old nests, and forcing them to seek a new one, so often, that I cannot doubt the truth of what I am telling you.”

“ I have observed, that at first there are very few carriers ; but, after a while, these few enticed others to join them in forming a new colony. It was amusing to watch the arrival of the recruiters at the old ant-hill ; they eagerly approached the ants, stroked them with their antennæ, pulled them with their pincers, and actually appeared to be begging them to go with them. When they seemed willing to set off, they seized them by their mandibles, the carrier-ant turned itself about to take up the other, which rolled itself up as it hung from the neck of the carrier. This was all quite amicable ; they stroked each other occasion-



ally with their antennæ, just as they do when they are about to take their food.

“ I have noticed, that it is not always in so peaceable a manner that the recruiters act; for they sometimes seize the ants by surprise, and drag them forward, without allowing any time for resistance.

“ This recruiting continued many days; and when all the ants belonging to the old hill were acquainted with the road to the new city, their companions ceased to carry them, and confined their labours to the construction of chambers and avenues in the new abode. When some of these were finished, they fetched the larvæ and pupæ from their old habitation, and deposited them in safety; after which, they escorted their males and females, and then abandoned their old hill for ever.

“ These little creatures are very particular in the choice of a place for their city, and often change it two or three times, if the situation does not please them.

“ I have known instances of the new ant-hill being at a considerable distance from the old one, and, in that case, the ants have a kind of half-way-house, in which they deposit their larvæ and males and females, which they cannot transport in one

journey. For this purpose, they make a hole in the earth, and even construct chambers, which they cover with bits of straw, and raise to look something like a small ant-hill. Here they station sentinels, to open the gates morning and evening, as at the real ant-hill. In the fir-grove on the hill, there is a number of large ant-hills, connected together by tracks, which seem like so many cities of one kingdom. The tracks, which are as much as a hundred feet in length, and several inches broad, are not caused by the passing and repassing of the ants, as one would naturally suppose, but are dug out of the soil by the ants themselves. This art is confined to the fallow ants; but the plan of recruiting, or rather of colonizing, is common to the fallow, the Ethiopian, the ash-coloured, the sanguine, and the mining ants. The valuable gift of communicating with each other by means of the antennæ, is in use among the brown, the yellow, the fuliginous, and many other kinds."

MISS R. "The affectionate care, which the ants bestow upon their young, and upon their companions, appears almost unaccountable to me."

"With ourselves," answered I, "affection springs from an acquaintance with the good qualities of a fellow-creature; but with ants, as with bees, it arises from an instinct, given, doubt-

less, for the benefit of their society. Their friendship is universal; they have no rivalry, no unkind feelings, to sow dissension among the members of the republic.

“You will think me too complimentary, if, after this eulogium, I venture to compare a republic of ants to the inhabitants of the white school-house of yonder village: if you will not allow the comparison, I will make bold to offer it as a model worthy the imitation even of my amiable and industrious friends.”

I observed Letitia and Sarah, and, indeed, the whole of the party, look somewhat sly, and half ashamed, as I glanced at them; conscious, perhaps, that there were too many different tempers and dispositions thrown together in their spacious school-room, to permit of that entire harmony which I had been describing as natural to the ants.

“Ants,” continued I, “may be even divided in the middle, and will still continue to defend their habitation, and convey their young to places of safety: thus, you see, they will not yield to our friends the bees, either in patriotism or in affectionate regard to their offspring. And with this compliment, we will leave them for the present.”

## CHAPTER IV.

“I SAW you smile, Letitia, when I was, last week, talking of the perfect harmony of the ants, and comparing it with the state of the inhabitants of a certain school-room. Alas ! discord is, I fear, inseparable from every state of society.

“We have seen that bees, usually so pacific and friendly towards each other, at times seem to forget their amiable character : and this, too, we shall find to be the case with ants.

“The ants of southern countries are more war-like than those of our own ; they attack small animals, and destroy rats. The ants we are acquainted with confine themselves to beetles and caterpillars for their largest prey ; they will, however, pull to pieces a dead frog or lizard.

“Ants are not sly, but make war openly. Strange to say, the females and the workers only are armed ; they have a sting, whose venom, you know, causes a slight irritation on the skin ; and this and their pincers are their only weapons. As the males are not armed, they are exempted from

the burden of war; and as the females only use their weapons for self-defence, and make their escape upon the slightest alarm, it is the workers alone whose lot it is to defend the habitation, or commit depredations for the good of the community.

“Some of the various species of ants are without a sting; but these bite their enemies, and then pour into the wound they have made with their teeth a drop of venom, which renders it exceedingly painful.

“But the most furious combats are between the ants themselves. Several little ones sometimes attack a single large one; they fasten upon its feet, drag it to the ground, and thus prevent it from escaping. The fury of these little things is incredible: you might tear away their limbs, or cut them in pieces, sooner than make them quit their hold. I have seen a victorious worker carrying about the head or antennæ of the ant he had conquered; and it is no uncommon thing to see one drag after him the whole body of his enemy, with which his feet had got so entangled during the battle, that he could not extricate himself.

“If the ants be of equal size, those with a sting have a great advantage over the others



The red ant has both kinds of weapons. In our country, the ants with stings are the smallest kinds.

“When large ants attack smaller ones, they seem to do it by surprise, to prevent the small ones from clinging to their feet. They seize them by the upper part of the body, and strangle them. When the small ones, however, have time to guard against an attack, they give notice of it to their companions, who come in crowds to their assistance.

“I once saw a battle between the herculean and the sanguine ants. The former quitted their abode in the tree, and advanced to the very gates of the dwelling of the sanguine ants: these were more numerous, though smaller, than their adversaries. They defended themselves bravely; but, great numbers of them being killed, they resolved to remove their habitation, and, with great activity, conveyed their young to a distance of fifty feet. A few workers were stationed here and there to guard their retreat, and preserve the new city from a sudden attack; these kept their mandibles open as a posture of defiance, and struck against each other when they met. When the herculean ants approached, the sentinels in front assailed them furiously; at first, they fought in

single combat. A sanguine ant would throw himself upon the herculean one, fasten upon its head, and shower its venom upon him. Sometimes, the herculean ant would seize his audacious enemy between its feet, and the two warriors rolled together in the dust. The largest ant, at first, had the advantage; but the numbers who came to the assistance of the smaller one, and the venom they all spurted, generally decided the victory in favour of the latter; while the herculean ant either perished, or was conveyed prisoner to the enemy's camp.

“Some species of ants engage in regular wars. The fallow ants, in particular, are jealous of every other kingdom of ants in their neighbourhood; and I have beheld pitched battles between two nations, whose territories bordered upon each other.

“Two armies met together, about half-way between their two hills, and formed a prodigious crowd of insects, which occupied a square of two feet in width. The battle began; the ants fought in pairs, and seized their antagonists by their mandibles. Numbers were employed in carrying off the prisoners, who made many attempts to escape, as if aware that they should perish when they arrived at the camp. The

scene of battle was about a yard square; numbers of dead bodies strewed the ground, and I perceived the strong smell of the venom with which they were covered.

“There were groups and chains of ants, holding each other by their legs and pincers: six or eight would all be firmly locked together, and a band of warriors breaking in would force them asunder.

“When night came, the two parties retired to their own habitations, but renewed the attack before daylight the next morning. The battle raged more furiously than ever; so desperately did they fight, that not even my presence could divert them.”

LETITIA. “But how can each of these little creatures know his own party?”

“Indeed, their instinct in this respect shews itself in a new point of view to us; but who shall attempt to explain it? The battle I have been describing terminated, at length, without the destruction of either ant-hill; long continued rains stopped the warfare, and our warriors ceased to frequent the path that led to the enemy’s camp.

“I could add innumerable anecdotes of the warlike disposition of ants, but am afraid of

wearying you. I should like you to accompany me again to my favourite hill, the abode of the fallow ants, whose nests we first examined, and see if we can find any engaged in their *gymnastic* exercises.

“ I see you stare with surprise at the term I make use of; but I will explain it. On a fine sunny day, I have seen the ants heaped together on the surface of their hillock. None being at work, I stooped to see what could be their occupation, and found they were actually wrestling one with another. At first, I thought they were fighting; but finding that they emitted no venom, and that none were wounded or hurt, I concluded they were amusing themselves with sham fights.

“ This rude kind of sport is not general among the ants; it is principally confined to the fallow ants. The others, however, have amusements of a different kind, and gambol and turn each other about as young dogs would do in their play.”

We reached the hill; but I could not prevail upon my young friends to be as cautious as the occasion required; the ants consequently took fright, and frustrated our design.

“ The most singular part in the history of ants,” continued I, as we returned homewards, “ is their

language; or, in other words, the use of their antennæ, those extraordinary organs, which perform so many important offices for the ants. I have already mentioned a variety of instances, in which they are of essential service to them, and I have others still to mention.

“Ants do not, like bees, build magazines and store them with food; some, therefore, are obliged to seek it daily; and it is their office to bring home a supply for those who do not go out. When they meet with ripe fruit, or juicy animals, such as worms, or lizards, which they cannot bring home, they feed upon them; and, on their return, disgorge the liquid provision into the mouths of their companions, in the following manner: the ant who is hungry, strikes with its antennæ the ant who has brought a supply of food; then, with open mouth and extended tongue, it draws near to receive the fluid, which I have observed to pass from the mouth of one to that of the other. All this time, the ant who is receiving food, caresses its kind friend by striking it rapidly with its antennæ, and stroking the side of its head with its fore-feet, which are furnished with brushes, and move as nimbly and gently as the antennæ.

“The ant who is returned with its stomach full, informs the hungry crew of its wish to un-

burden itself of its store, by striking its antennæ; a movement which even the larvæ understand, who erect themselves, and present their mouths as soon as they observe it.

“There are small insects, called *pucerons*,\* or *aphides*, which live upon vegetable substances, and are found fixed upon the leaves, or young branches, or between the fibres of the bark. After sucking in their nutriment, they expel it in the form of small drops, and it is this fluid that forms the chief nourishment of ants. They watch the moment when the pucerons are about to eject it, and immediately seize it; and they likewise have the art of obtaining it at whatever time they wish. An ant reaches a leaf which contains several pucerons, and approaching one of them, strokes its back with its antennæ, as if to caress it, upon which the puceron ejects the fluid, and the ant immediately sucks it up. The ant then comes up to another puceron, and obtains another supply of fluid by a similar manœuvre; and, after visiting four or five, returns contentedly to its nest. A few repasts will satisfy it.

“These pucerons, if there are no ants near them, scatter this liquid to some distance, or drop

\* *Pucerons*, French, a genus of wingless insects, with fewer than six pair of legs.

it on the leaves, from which the ants frequently take it.

“The brown ant is the most skilful in obtaining this honey from the pucerons; the fallow, the ash coloured, and the red, have a similar power, though not in an equal degree. The red ant receives this drop, and with great dexterity employs its antennæ to conduct it to its mouth.

“Ants are also indebted to the gall insects for a supply of food, which is ejected from a hole upon the back; these, like the pucerons, feed upon the juices of leaves and branches of trees. The ants stroke them with their antennæ and lick up the sweet drop ejected by these *gall* insects, or *kermes*, in the same manner as they lick up that from the pucerons.

“When the ants are not present to receive it, the *kermes*, like the pucerons, scatter the fluid to some distance.

“This food is a never failing resource to the ants; I have seen thousands of them ascending and descending the trunk of an oak covered with these insects. Those ascending are thin, and walk quickly; those descending have their stomachs filled, and move with difficulty.

“I have often puzzled myself to discover what

those ants do, who never quit their abode; the yellow ants, for instance, called by the common people red ants, who frequent our meadows and orchards. These are literally subterranean insects, and neither go in chase of other insects, nor suck the sweet juices of fruit.

“One day, however, I turned up the earth of which their nest was composed, and found it contained pucerons of various species, some white, others flesh-coloured, others green and violet.

“These pucerons subsist upon the roots of plants, and may be seen after rain, when the plants can be easily pulled up by the roots.”

LETITIA. “But how do the pucerons come there in the first instance?”

“They are,” replied I, “most probably carried thither by the ants, who know full well the value of these little beings; for, in fact, they constitute the sole wealth of an ant-hill; they are their cattle and their sheep. I am inclined to think the yellow ants search for them in the subterranean galleries they have dug out, and finding them among the roots, bring them to their nest.

“Many species of ants have these pucerons in their nests; the red, the brown, and the surf ants, are in possession of them in winter, spring, and autumn, when other food is scarce.

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“Some other insects, likewise, live among the ants, such as woodlice, earwigs, &c., but they do not seem either to be of use, or to be troublesome to them.”

LETITIA. “You once said that it was a mistaken notion, that ants laid up stores for winter use; and that the bits of wheat and other grain found in their hills, were not to form granaries, but to assist in the building of their habitations. If this be the case, how do these little insects subsist during winter?”

“When the weather is very cold, ants are, like bees, in a kind of torpid state; but only during extreme cold. I have seen ants walking over the snow. It is during this season, when other food fails them, that they are entirely indebted for their preservation to the pucerons, in whom they have a never failing resource. Those ants who have not the art of bringing the pucerons to their own nest, know how to find them out upon the branches or within the bark of trees, and obtain a supply of food from them.

“The eggs of the pucerons are guarded by the ants with the same jealous affection as their own; they carefully conceal them from observation, and pass their tongue over them, to glue them together, in the same way as they do their own. They are hatched in the spring; and the almost full-

grown insect starts from its shell, and rewards the ants who have so carefully watched and preserved it, by supplying them with nourishment."

I was here reminded by my young friends, that their visit must be a short one, in consequence of their having a concert to rehearse, which was to take place on the following Saturday; and which would also interrupt their weekly attendance at my cottage.

The disappointment to myself was somewhat alleviated by a polite invitation to this concert, from Miss R., which I most willingly accepted.

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## CHAPTER V.

THE concert passed off exceedingly well; and, if I had been gratified by the thirst for information displayed in the eager attention of my young friends to my humble lectures, I was no less charmed to see them display the lighter accomplishments and graces suited to their age and sex.

The concert was followed by a ball; and here Letitia bore away the palm, as Sarah had in performing her concerto upon the piano. The old bachelor was not allowed to escape without making himself ridiculous; and, before the evening ended,

he had displayed his antiquated notions of dancing in a country dance, which followed all the fine figure dances and quadrilles.

“It is well, my young friends,” said I, when we next assembled, “that you have had a week to laugh at, and, I hope, forget, the droll steps of your lecturer; otherwise he might not, perhaps, be listened to with that gravity which is suitable to his present office.

“I grieve to say, that office is coming to a conclusion; and that, after next week, I quit this summer retreat, which your occasional visits have rendered a most agreeable one to me. I will lose no time in telling you all the other facts I have been able to glean; they relate chiefly to the habits of some kinds of ants different from any that I have before mentioned.

“I shall begin with the *rufescent*,\* or, as I have named them, the *amazon ants*. The warfare they carry on with other kinds of ants is of an extraordinary description. I have seen an army of them, extending about eight or ten inches, moving rapidly along, quit the road, pass a hedge, enter a meadow, and, winding along the grass, without straggling, approach a nest of dark ash-coloured ants. Some of its inhabitants were guarding the

\* *Rufescent*, from the Latin *rufesco*, inclining to a red colour.

entrance of the dome; and, on seeing the enemy approach, they darted forth upon its advanced guard. The alarm was given, and the ants came pouring from the interior of the nest. The amazon army, quickening its march, arrived at the foot of the ant-hill, and in an instant fell upon the ash-coloured ants, who retired, defeated, to the bottom of their nest. The amazons now ascended the hillock, crowded upon the top of it, and took possession of the different avenues; while some with their teeth endeavoured to make an opening on the side of the dome. They succeeded; and the amazon army entered the nest, out of which they soon returned, each bearing a larva or pupa in its mouth. The whole army now returned by the path along which they had come, but all in disorder and confusion; I could distinguish them in the grass, by the white eggs they carried, but as they entered a field of corn, I lost sight of them. I went back to look at the conquered ant-hill, and found a few ash-coloured ants perched upon the stalks of plants, holding in their mouths the pupæ they had been able to rescue from the amazons.

“This battle would not have surprised me half so much as it did, had it not been for a discovery I made in some ant-hills near my house.

“I found, to my utter astonishment, that there were ash-coloured, or negro workers in every nest of amazons; and I found, too, that they lived on very friendly terms together: that the negro ants received the amazons whenever they returned from an attack, such as I have described, helped them to unburden themselves of the captive larvæ, and to deposit them in proper cells. These, therefore, may be called compound ant-hills, since they are composed of two different kinds of ants. They, no doubt, originally belong to the amazon ants, and the negro labourers proceed possibly from the larvæ which have been taken prisoners in war. These, being hatched and brought up in a strange nation, not only live sociably with their captors, but assist them in taking care of their young, in removing their habitations, seeking provisions, forming new galleries, acting as sentinels, and, in short, they lead the same active lives which they would have done had they been born and brought up within their own nest.

“The amazon ants leave all their domestic care to their negro slaves, and reserve themselves for their warlike expeditions. I destroyed a part of their nest, upon one occasion, while the amazons were absent: the negro ants immediately set to work and built new galleries; the consequence

was, that when the amazons came home, they did not know how to get into the inside of the nest. I saw an amazon go to a negro and apply its antennæ to it, as if asking something; and I then noticed the negro take it up with its pincers, and deposit it at one of the entrances: the amazon unrolled itself, caressed its kind friend, and entered its dwelling. Sometimes, they will carry the amazons some distance, if they have quite forgotten the road about the galleries. It is a curious sight, to see a number of these little industrious negro ants, each bearing one of its warlike comrades upon its back.

“ There are other kinds of ants, who form compound ant-hills. Such are the *mining ants*, who likewise unite with, or are the slaves of, the amazons. These miners form vast ant-hills, much larger than they would construct for themselves: they go out in a crowd from morning till evening, to forage in the neighbourhood, and provide food for their colony: on their return, they share their food with the amazons, who are as lazy in this colony, as when they live with the negro ants.”

LETITIA. “ The ash-coloured and mining ants may be looked upon as negro slaves to the amazons, stolen before their very birth, and ignorant of their being in a land of strangers.”

“In fact, they are so,” answered I. “I have another association of ants to introduce you to, which are the *sanguine*\* *ants*, who are likewise indebted to their negro brethren for their valuable services.

“The sanguine ants resemble the fallow ants, except in colour; their head, feet, and throat, being of a blood hue. Their hills are composed of fragments of leaves, stalks, moss, and stones, and as difficult to break as mortar. It is not the work alone of the negroes; for, unlike the amazons, the sanguine ants share the labours of the nest with their slaves.

“The sanguine ants are not so warlike as the amazons; their chief employment is in hunting small ants, which they eat: they leave the nest in troops, and lie in ambush near an ant-hill till the inhabitants come forth, whom they dart upon and make their prey.

“The sanguine ants make war against the ash-coloured; and, like the amazons, seem only anxious to bring away the larvæ and pupæ. I could amuse you with a history of many a battle, or rather a siege, in which I have observed every stratagem that skilful generals and well-practised soldiers could devise and perform; but I hope that

\* *Sanguine*, from the Latin *sanguis*, blood.

I have sufficiently interested you to induce you to make observations for yourselves. I refer you to nature; there you will find inexhaustible stores of amusement and interest: and you will ascertain that, far from exaggerating the truth, I have still left much for you to learn for yourselves.

“I have given you the principal facts which are known relating to ants; and I have opened to your inspection “Scenes of Industry” in the insect world, worthy of admiration and imitation.

“Nor can I take leave of you, my young friends, without adding, that I have ill succeeded in the task I proposed to myself, if I have not, in some degree, increased your reverence and affection for that Being, who gave to these little insects those wonderful instincts, which are so admirably adapted to the duties they are destined to fulfil.”



## WONDERS OF THE INSECT WORLD.

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### CHAPTER I.

THE increasing curiosity of my young friends at Bray, and the ardour they shewed in the pursuit of knowledge, encouraged me to impart to them a few more of the wonders of the insect world.

“Useless! Miss Letitia,” said I, when my little auditors were once more collected around me, in my cottage garden; “surely you forgot the silkworm, when you called all insects *useless*.”

“I spoke in ignorance,” answered the candid little girl; “and have long since been convinced of my error. I wish to hear about silkworms, though I do not expect they will interest me so much as my now favourite bees, and the industrious little ants.”

“I have ample materials for gratifying your curiosity; and will first give you a general account of the caterpillar family, which contains at least

three hundred different species. In form and colour, each species differs from the other; but they have all a resemblance in some things; for instance, they are all formed of so many rings, which they extend and draw in as they move along: they are all provided with a number of tiny feet, which bend and move by means of small joints; these feet are armed with claws, by which they fasten themselves to the under part of leaves, or branches, particularly when asleep. Most caterpillars are likewise provided with a thread, which they spin out of a gummy matter collected from the leaves they make their food of. This gum is one of their means of defence; when terrified by the appearance of a bird, or the motion of the branch they are upon, they drop a small quantity of gum upon the tree, then, darting forward, spin it as they descend. The delicate thread is formed by the gum passing through several small holes in the insects' body; from each of which is produced a distinct fine thread; the insect unites these threads into one with its claws, and cements the combined cord with its glue; thus making a rope strong enough to support the weight of its body. All this is done in less time than I have taken to describe it.

“ You observe that many caterpillars are co-

vered with a soft downy hair, which serves as well to protect them from the moisture to which they are constantly exposed, as to warn them, by the vibration of the delicate hairs, of the approach of an enemy. It also prevents them from being injured by a fall, should their thread happen to break.

“This feeble insect is provided with another and more effective means of defence in the colour of its body, which, almost always, is the same as that of the plant or tree on which it feeds. We shall probably find a caterpillar on that buckthorn, for instance, as green as the plant itself; while those which feed upon the apple-tree, you may perceive, are tinged with brown, resembling the bark of that tree.

“It is a curious fact, too, that every different species of caterpillar has a different tree, or plant, upon which it feeds; and it will rather die of hunger than attempt to gain nourishment from any other.”

“That,” cried Letitia, “you consider a fortunate circumstance, do you not? What would become of our apple orchards, if every species of caterpillar were to regale itself upon the trees, when one alone often does so much injury? And now,

will you be kind enough to tell me, if you rank caterpillars among those you call useful insects?"

"All the common species of caterpillars, *Letitia*, I believe, are only useful as affording food for birds. Destroy worms and caterpillars, and what would become of your favourite songsters? It is to supply their infant broods with food that Nature has everywhere scattered these insects with so liberal a hand; until the month of April, in which the young are hatched, there are no caterpillars; the parent birds being able to supply themselves with grain enough for their support, before that time.

"The life of insects in their caterpillar form is short: towards the end of summer, when, having shed their skin several times, they are satiated with green food, they employ themselves in building a house, or rather a tomb, in which they are to be metamorphosed from a caterpillar into a butterfly. This change, in some species, takes place in a few days, in others it occupies several months, during which the insect remains buried in its tomb.

"In the bee tribe, as well as in some others, the insects employ their ingenuity, when full-grown, in constructing habitations for the preservation of

their eggs and their young. Caterpillars, however, begin their building in the first stage of their life, and, inexperienced as they are, construct galleries, tents, and cities, with astonishing skill.

“ But the evening is drawing in. Before I commence this part of my history, I will bring my insect to the last stage of its existence; and then, in the parlour, we shall have time both to examine the fine moths and butterflies in my cabinet, and to talk over the feats of each kind while in its larva, or caterpillar state.

“ Some kinds of caterpillars bury themselves in the earth at the beginning of their metamorphosis; they then shed their skin, which comes off, with the head and paws attached to it, shrivelled up like a piece of parchment. A small oval ball, like a bean, and of a brown colour, the extremity of which terminates in rings, diminishing as they approach the point, now takes the place of the caterpillar, and this is the *chrysalis*, or the insect in its third, or pupa stage. Within this shapeless mass, lies concealed the embryo butterfly, surrounded by a fluid, from which it receives its nourishment. When its growth is completed, and the warmth of the sun has reached it, the full-grown butterfly bursts its shell, and starts forth,

in all its beauty. The widest part of the chrysalis, which always contains the head, opens first.

“Some species of caterpillars spin themselves a covering, in which their metamorphosis is to take place: among these, is the silkworm. The spinning caterpillars most common with us are met with on elm and apple trees. The butterflies which proceed from them, fix their eggs upon some of these trees in the autumn, and then die. The autumnal sun has sufficient warmth to hatch these eggs, and before the winter sets in, hundreds of little caterpillars spring forth, who immediately set to work spinning houses for themselves. With marvellous ingenuity, these little creatures, who are as expert as if they had served an apprenticeship to the work, form separate apartments, as well as beds, and thus shelter themselves from the winter’s cold, during which they live without eating. There is one opening to this house, and out of it the little inhabitants sally forth on a sunny morning. The outside covering is so compact and firm, that some little strength is required to break it, in order to reach the inside, which discloses the whole family reposing upon a bed of down, and surrounded by several folds of their self-spun web. The time at length arrives

when the little creature is ready for its escape; its head forces its way through the opening; the horns lengthen; the head and wings extend themselves; and the butterfly takes its flight through the air without retaining the slightest resemblance of what it was before.

“Now,” continued I, as I led the way to my cottage, “I will open for you my cases of butterflies; and, I promise myself, you will be delighted with the variety and brilliance of their colours.”

We entered the sitting room of my cottage, and the table was quickly covered with cases of preserved moths. What recollected pleasures did the sight of them occasion! The pure morning air, which had regaled me while I chased them; the ardour of pursuit; the pride of victory; the delight of possessing and of classing them!

Letitia was most charmed with my first case. “What lovely tints!” she exclaimed. “How soft and delicate! I much prefer them to the more showy and gaudy ones.”

“These, I call my *owl papilios*;\* for they are of those species which make their appearance only by night. The first division contains moths that gnaw stuffs. You observe their heads and bodies, which seem as if thrust out of a kind of

\* *Papilio*, Latin, a butterfly, or moth.

muff; that is their self-made habitation. The young one, when she leaves the egg, that has been deposited in a piece of stuff, or cloth, finds a habitation, as well as clothing, in the nap of the cloth. This is our enemy, the common clothes' moth; and though so injurious to our wardrobes, we must give it credit for being most skilful and industrious, both as tailor and architect. It actually forms a clothing for itself, which fits close to its body, and is made like our coats of wool, or hair, felted together. The form of this house, or coat, for it serves both purposes, is cylindrical, with an opening at each end. The hair is wove or matted together with glue from the insect's own mouth, till it becomes a hard tough substance, within which is a lining of pure silk, of the softest texture, which forms a bed for its tender body. Now remark the most singular part of the story; this dress fits the insect in its earliest infancy, while its body is small; as the insect grows, therefore, the dress must be enlarged in proportion. How does it contrive this? In the most skilful manner that can be imagined. If the dress want length, a new ring of wool, or silk, is added to it at each end; if width, the little insect sets to work as any of you would do. It slits it up on each side, and puts a new piece in.



But if it were slit all the way along at once, the insect within would be exposed to the cold air; it prudently, therefore, cuts up only one half at a time, and after it has inserted a piece there, it cuts through the other half, and finishes the patch: four pieces being thus required before the work is complete. Now the colour of their dress always corresponds with that of the cloth they have been feeding upon. If the first dress were red, and the moth removes to some stuff of another colour, say green, the colour of the patch will be green: if it move again before the patch is completed, and perches upon a piece of yellow, the remaining part of the patch will be of that colour: so that these little creatures sometimes resemble a harlequin in his many-coloured dress. When the insect has cleared all the hairs around it, it marches off, with its coat on its back, to some other part, making a smooth road for itself, by cutting down all the hairs in its way with its teeth, which perform the part of a scythe so capitally, that as much mischief is done in the march, as during the labours of the insect. When it has a mind to rest, it fastens itself down, by means of the fine silken cables with which it is always provided.

“ Now you must direct your attention to my

little *miracles of nature*, those tiny moths, in whose wings are the brightest tints, splashed, as it were, with gold, and silver, and pearls. These, during their caterpillar state, are most skilful miners; and actually form galleries beneath the fine skin of the dandelion and bramble leaves. By eating the pulpy substance between the outer and the inner skin, they bore out a gallery, which looks like a zig-zag line, at the end of which you may perceive a brown speck, which is the insect in its leafy habitation.

“ Here is one of the New Holland moths, whose contrivances for defence are very remarkable. It forms its habitation, while in its larva state, by boring a hollow in trees; and, to defend the entrance of this from carnivorous insects, such as the mantis, it contrives a sort of trap-door. This is composed of silk, woven with leaves and dirt; it is fastened down at the upper part, but left loose at the bottom, that the insect itself may go out when it pleases. Every day at sunset, the insect goes out to collect a store of leaves for food; and it is employed all night long in dragging one leaf at a time into the cell. When daylight approaches, it hurries home, and shuts itself up, to feast during the whole of the day. One species of trap-door moths lifts up the end of the door with

its tail, and goes in backwards, dragging a leaf with it.

“ In this part of my case, I have a set of ingenious little moths, who form habitations out of leaves. Some join a few leaves together, by means of their silken threads, and dwell in the centre of the cluster: others shut themselves up in a single leaf, which they fold over them. I have some, too, who form more complicated houses, which are furled up into little cones, the points of which have little openings, by which the insects can escape when they please.”

Here I was interrupted by Letitia, who begged I would explain how an insect, without fingers, or tools, could roll up a leaf, which is not a very flexible substance.

“ It is a curious operation. The caterpillar fastens its silken cords from one end of the leaf to the other, pulls these cords with her teeth, and fastens them with shorter threads. If she finds the large fibre of the leaf too tough to bend, she gnaws it with her teeth, to weaken it. The roll which forms her habitation is not made out of a whole leaf, but of a thin slip, which she cut off from one side of it with her teeth. She does not detach the whole of the leaf, but cuts out a triangular strap, which she rolls as she cuts. When

her little cone is finished, she artfully raises it so as to bring it into a perpendicular position, by fixing her threads towards its point, and drawing it up by the weight of her body.

“I could amuse you with the history of numbers of moths, almost as clever as those I have already described ; but I must not forget to gratify the curiosity of Sarah, whose eyes have long been fixed upon the brilliant butterflies in my next case. The colours, it is true, are beautiful ; and you will recognize many friends. Observe that range of blue-winged moths ; they meet our sight everywhere in the spring. And how gay and lively do they make the garden, flitting about us, as if they were created purposely to please us. Look at that one, in which the rich green is so finely contrasted with the black velvet in its wings ; and the whole is so set off by the lively yellow of its body, that it is named *Priamus*, after Priam, the unhappy king of Troy.

“ This, in the next case, is the race of *coppers*, whose wings are tinged with a metallic lustre ; in some of them, the larger wings are tawny, spotted with black, and the under part of the smaller wings have what appear like silver spots.

“ You will be amused to hear, that among butterflies, those which have black wings with red

spots are called *Trojans*; and those with black wings and yellow spots, are denominated *Grecians*; names imposed by Linnæus, for the purposes of distinction and classification.

“The most striking ornaments of butterflies are the many-coloured eyes, which decorate their wings: some have them on all four wings, others on only two; but the most surprising fact is, that it is not the substance of the wings themselves that presents so lovely a picture to our eyes, for it proceeds from clusters of minute feathers, each ending in a quill, and so thickly planted in each side as to conceal the membrane which constitutes the wing. The number of these small feathers, which, when you take the butterfly between your fingers, resembles the finest dust, is almost infinite. On the wings of a single silk-worm moth more than 400,000 have been counted. And on a larger butterfly, the number must, of course, be much greater.

“Many of the butterflies have transparent spots upon them, occasioned by the absence of these feathers; these may be termed windows in their wings: others are entirely transparent; and in some species, a very fine short hair takes place of the feathers. That light brown butterfly, with gray streaks and golden dots, named the *Painted*

*Lady*, is one of those whose colours occasionally vary ; sometimes you may find them of a golden brown or yellow, and sometimes of a light green. — This is the *Purple Emperor*, which you may meet with in the neighbourhood, and at the entrance of your favourite resort, Oakley Wood ; but is never to be met with except in such haunts.”

“ Ah,” said Letitia, “ often and often have I met with it there ; but I never could catch one. I found, whenever I threw my handkerchief over the bush, that the butterfly had always contrived to escape at some corner or other.”

“ You should exercise a little ingenuity, Letitia. I have a fly-net, and a bag-net, on purpose. But, I think, you might make one of a more simple kind : for instance, tie a gauze handkerchief at its four corners to two long pieces of cane, or stick. When you have hunted down a beautiful butterfly to a bush, you have only to extend both hands, cover the insect with your gauze, close your sticks, secure your prize, and bring it safe home in a small mahogany box, which you must carry about with you. Nip it on the breast, to ease the pangs of death ; stick it with a fine lace pin, and stow it in your case.”

My attentive auditors all thanked me for the hint that they should turn butterfly hunters ; and

assured me they would each present me with their first prize, for the benefit of my cases.

These butterflies and moths had a little turned me out of my way: I had still to give my promised history of the most useful of all insects, the silkworm. Miss R. kindly gave her consent that her party should once more assemble round my tea-table and finish out the evening from the naturalist's store. I promised to carry my little lantern to light the party home, if neither moon nor glow-worm made their appearance; and, after tea, we resumed our discourse.

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## CHAPTER II.

“YOUR curiosity shall, at length, be gratified by the history of the silkworm; the insect which provides us with that useful article of dress, silk. In this country, we use it chiefly as a luxury; our silk dresses, silk stockings, and other things, might be superseded by those made of woollen or cotton; in other countries, it is, however, an article of manufacture, in which hundreds of people are employed, and gain their maintenance by it. In some parts of India, and in China, it is one of the chief objects of cultivation, and supplies all ranks

of people with their common wearing apparel; this has been the case from time immemorial, even when, in Europe, silk was scarcely to be had for money. In Rome, at one time, silk was so valued, and so scarce, that it was sold for its weight in gold; and the Emperor Aurelian actually refused to purchase a robe of it for his Empress, on account of its costliness."

"Yes," cried Letitia, "I remember another anecdote, which I met with in *Tales of my Grandfather*, which proves how rare it must have been in Scotland, when King James the First was reduced to borrow a pair of silk stockings from one of his nobles, the Earl of Mar, to receive the English ambassadors in; 'that,' as he said 'he might not appear a scrub before strangers.'"

"It was from Asia," I continued, "that silk was first brought. By the ancients, it was called *Sericum*, the name of the country from which they supposed it to come. What produced it, however, none could discover. Some imagined it to be a fine down, procured from the leaves of certain trees, or flowers; others believed it to be a delicate species of wool, or cotton: of those who supposed it to be an animal production, some thought it proceeded from a spider-like insect, with eight legs, which was fattened with a kind of



paste and the leaves of the green willow, till it burst with fat. Others thought it might be the produce of a worm, which formed nests of clay and stored up wax. About the middle of the sixth century, however, the real discovery of the method of cultivating and manufacturing silk was brought into Europe in the following manner; two Persian monks, who had been employed in several parts of India, penetrated into the country now called China, where they observed the labours of the silkworm, and the method of manufacturing silk. They procured a few eggs of the silkworm moth, and, concealing them carefully in a hollow cane, carried them by stealth to Constantinople, where they were hatched, and quickly increased their numbers. From Turkey, as it is now called, they were afterwards spread to Italy, in which country alone they were cultivated to any extent, till the time of Henry the Fourth of France; who, observing that mulberry trees, the food of silkworms, were plentiful in his kingdom, introduced them into the south of France; and there silk is now manufactured.

LETITIA. "Are they not troublesome little things to rear? My brothers brought some home from school with them; but, as I was at home

only a short time, I had no opportunity of attending to them."

"There are two methods of cultivating them. In the hot climates of the East, the worms attach themselves to the trees, of whose leaves they eat, in the open air. The moths, in this case, fasten their eggs with their glue to the under side of the leaves of the mulberry-tree; and, thus sheltered through the instinct of the parent, the eggs remain through the autumn and winter. When the warm spring sun brings out the young leaves, the worms break from their shells, and disperse themselves among the branches: in a few months, they form their silken balls, and the trees then appear as if sprinkled with beautiful little golden apples. This is the most natural and healthy manner of rearing the silkworm; but it is unsuited to the changeable nature of an European climate; and there is, besides, a difficulty in preserving the worm from birds and large insects.

"A habitation is therefore necessary for silkworms in the European countries, where they are cultivated for purposes of commerce. The following is the plan adopted in some of the silk districts in the South of France: an airy and sunny apartment is chosen, the windows of which

are covered with cloth, besides being well glazed, to prevent any cold wind from entering: the walls are kept well plastered, and the floor is quite secured from the admission of birds, rats, or insects. In the centre of this room, four poles are placed, so as to form a square, between which osier hurdles are swung and ranged one above the other, in the manner of shelves: beneath every shelf there is a ledged board, which draws out and in upon a groove. The eggs are placed in boxes; and some young mulberry leaves are scattered over them, as soon as they are hatched: when the worms have grown a degree stronger, they are distributed along the shelves, where they feed upon mulberry leaves, and become vigorous, climbing backwards and forwards upon the osier twigs. They are supplied every morning with fresh leaves, which they seize upon, and immediately abandon the old ones, the remains of which are most carefully removed, as damp and dirt are fatal to the worms. For this reason, the leaves must be gathered upon a dry day. Should the mulberry fail, the leaves of lettuce or hollyoak, will do to supply their place, though the worms are not so partial to them. A small portion of air must be daily let in during the sunshine; and the whole place kept very clean and free from litter.

“ These are dainty little creatures,” said Letitia ;  
“ and pray how long do they remain in a state to  
require such nice attention ?”

“ They pass through many different stages.  
When first hatched, the silkworm is a small  
blackish grub, with a shining black head : in a  
few days, it changes to an ash colour ; then it  
becomes dingy and ragged, and the worm casts  
its skin. It now grows larger and whiter ; its  
body being tinged with the green colour of its  
food. It ceases eating ; and, soon after, for about  
a couple of days, is in a state of torpor, or sleep :  
it next becomes restless and agitated, and its body  
turns red, as if heated by the agitation of its  
movements. Its skin wrinkles, then shrinks into  
folds ; the worm again casts it, and reappears in  
a new and very spruce dress, in form as well as in  
colour much changed. It eats again ; again re-  
turns to its state of lethargy ; and once more casts  
its skin. After that, the worm continues to eat  
for a few more days ; then it prepares to quit the  
world, and begins to spin itself a silken tomb.

“ You will probably like to know how they  
spin the beauteous silken thread, with which they  
form their cocoon, or ball ; and from whence it  
proceeds. I must anatomize a silkworm’s body  
for you ; and my best microscope will be required

for this purpose, on account of the extreme delicacy of its internal construction.

“ This worm, you perceive, is formed of several elastic rings, with feet and claws attached to each of them. It has a small skull covering the brain, which extends in a line through the whole length of its body: the mouth contains two rows of teeth, which move, not up and down, but sideways, from right to left; this enables the insect to cut the leaf as we cut our cloth with scissors. The silkworm has a head, a spine, and lungs: it has likewise a stomach: these are all enclosed, with numerous folds, by its gum bag. This bag is of a golden hue, and provides the worm with her materials for spinning. Her instruments are these: beneath her mouth, there is a little plate, perforated with two holes, through which, with all the skill of a wiredrawer, she draws two drops of gum from her bag; these she fastens to some leaf or stalk, then draws back her head and lets herself fall. The gum, passing continually through the holes, forms two threads, which, as they lengthen, unite, and become consistent: the threads, thus formed, she spins by the movement of her head, assisted by her claws; and, I can assure you, her attitude is most graceful when she is thus employed.”

“How,” said Letitia, “do they contrive to enclose, or wrap, themselves up in their own silken web?”

“The outside of the cocoon is thin, transparent, and gauze-like; and through it can be seen a small oval ball, of a firmer texture:—the whole is spun with one thread, but differently arranged. The outside, which is the mere scaffolding, used by the worm for the more solid part of her house, is formed first. The caterpillar chooses her situation in a small nook, between two leaves, or twigs; she glues one end of her thread to one side; then passes to the other, and does the same: she goes backwards and forwards, till she has completed this loose kind of network; and when she has spun enough of this, she lays the foundation for her inside building. — She fixes her fore legs to some of the first spun threads, then passes from side to side in a more methodical manner; when she has finished one piece, she changes her place, and so on, till the whole circular fabric is completed. The silken thread of this finer ball is therefore not wound round and round, but backwards and forwards, making a number of zigzags in distinct layers; as many as six, or more. The thread of this wonderful little ball may be wound off whole; and, without reckoning the outside

cocoon, is frequently of the amazing length of a thousand feet ; —so that the united silk of five cocoons would amount to a mile ! Five or six of these threads are required to make a single thread in the silk manufacture. Those spun from the inside cocoon are most valued ; the other comes off in ravels, and is what you use as *flos silk*.

“ Many other caterpillars, besides the silkworm, spin cocoons, which, in texture, size, and colour, are various : most are of about the same form as that of the silkworm ; the colours, too, are mostly white, yellow, or brown, in all shades : the yellows are often very brilliant. Sometimes, a cocoon is of two different colours. Some few are black ; some green, blue, or red ; but these are rare.

“ I must now return to the little inhabitant of this singular, and lovely ball. When it has been enclosed for some little time, it again casts its skin, and assumes the pupa form, its last stage of existence. It is now time for it to make its escape ; and the same instinct which taught the caterpillar how to construct herself a habitation, has led her to quit it, when no longer suited to her purposes. The ball, which resembles a pigeon’s egg, is more pointed at one end than at the other : and the insect, aware that this pointed part is to be the outlet for its escape, is careful never to place it near

any substance that might obstruct its flight, nor to cement it with its own glue, nor to weave its web so thickly over that as over every other part. At length, the moth, having completed its transformation, bends with its head, horns, and feet towards this point, which gradually gives way to its efforts, when the opening enlarges, and the moth comes forth. The skin of the silk moth, and that of most other moths and caterpillars, is left behind them in the cocoon: there is one kind, however, which throws it away out of a little hole in its cocoon. With the skin remains a quantity of moist excrement, which is injurious to the silk. The cultivator, therefore, does not allow the insect to complete its metamorphosis, but exposes the greater part of his balls to the heat of the sun, which shortly kills the worm within. A few moths only are suffered to remain, to produce eggs sufficient for the next year's crop. Here is a silk moth; it was first of a yellowish hue; afterwards, it became blue; now, as you see, it is of an ash-colour."

LETITIA. "I remember hearing my brothers say, that the winding off the delicate threads from the ball, required more patience than they possessed — how, then, can enough be procured for use?"



“ When the rough and tangled silk of the outer cocoon has been cleared away, the finer balls are immersed in warm water; they are stirred about with small twigs, to discover the beginnings of the threads, which, when found, are drawn through small rings, to prevent the balls from rising out of the water. These are wound round a reel, five or six, or more, at a time, in proportion to the thickness of silk required. The silk loses its yellow colour, as it comes nearer to the end, and the remainder is wound upon separate reels, to be used for different purposes. The little balls, when deprived of all their silk, are not entirely useless: some are carded, like wool, and made into a silken flax; others are prettily painted, and made up into artificial flowers.”

My little auditors expressed themselves greatly interested with this history of the little silk weavers. And as I assured them that I had facts almost equally curious about other spinners, especially those of the spider kind; I was overwhelmed with entreaties that I would finish the evening in company with spiders.

“ I have,” said I, “ a store of information, quite worthy of your attention; but I am surprised you should desire to hear details of an insect, which

many young ladies profess to have almost as great a horror of as of the toad !”

MISS R. remarked, that she had heard one or two curious stories of attachment to spiders ; particularly that of a gentleman, who, while imprisoned in the Bastille, amused himself with taming a spider ; and found it so docile a pupil, that he taught it to come out for its food at the sound of music. Also, of a manufacturer in Paris, who fed upwards of eight hundred spiders in a room, and when he entered the apartment, as he usually did, with a dish full of flies in his hands, the spiders would come round him to regale themselves with the delicious food.

“ Ah !” cried the younger Miss R. “ I think, I can match you with wonderful stories ; though you will hardly give me credit for speaking the truth, when I tell you of a young lady, who used to crack and eat every spider she met with : and of another young girl, who was as fond of them as nuts : and of Lalande, the famous French astronomer, who delighted to eat them ; and of a German, who spread them on his bread, and ate it like bread and butter !”

“ I certainly,” said I, “ never before thought of spiders as dainty food ; but as clever little architects, I have long felt a respect for them : though

I still prefer seeing their well-constructed fortified castles anywhere rather than in the corners of my room.

“ The spider’s web, is, in fact, a wonderful structure. If a cat or a dog were to form so complicated a mansion for its habitation, we should be truly amazed. Why should we be less so, because we see a smaller animal capable of so much contrivance ?

“ There are five different kinds of spiders, all of which have some common resemblance. There is the *house spider*, who spins her web in every hole and corner not explored by the busy brush of the maid ; the *garden spider*, who weaves her small round web in the open air, and lives in the centre of it ; the *black spider*, which inhabits cellars and the hollow parts of broken walls ; the *wandering spider*, which forms no nest ; and, lastly, the *field spider*, or the *long legs*. Every spider is formed of two parts ; the fore part contains the head and the breast, which has fixed to it feet, covered with strong scales ; and the hinder part, which is formed of a very thin and supple skin, covered with fine hair ; these two parts are joined together by a slender thread. The number of the eyes in the different species is not always the same ; some have eight, others only six ; of these

two are placed in the head, two in the hinder part, and the rest in the sides. They have no eyelids, but the eyes are covered with a hard transparent crust, and are immoveable, but their number and situation enable the spider to look all around and guard itself from the attacks of enemies. Every spider is armed with a couple of stings, or horns, projecting from the head; these are indented at the edge, like a saw, and terminate in a nail, like the claw of a cat; near the point of the nail, is a small orifice, through which they eject their venom, or poison. Thus the spider is armed with weapons truly formidable; they open and extend their two horns, and when they have reached their prey, they bend the nail down, and close it upon the horn, as you would the blade of a clasp knife. Spiders have all eight legs, each provided with three claws, which have distinct movements; one, smaller than the rest, is placed like a spur on the side, and it is with this the spider clings to its thread, and, as it were, climbs up it; the two larger claws have their inner edge indented, and these, by clinging to every substance, enable the spider to fix itself upon whatever it pleases, and to slide either onwards, or in a slanting position, or with its back downwards. You have, perhaps, observed that both flies and spiders appear to

walk, or slide, with perfect ease, over looking-glasses and the most finely polished marble chimney-pieces; it is the peculiar construction of these wonderful claws that enable the insect to do what would appear to us an impossibility. These delicate little paws, however, would soon be worn out, or materially injured, if constantly in use; the spider, therefore is provided with two tiny round balls, or sponges, with which it treads whenever the claws are not absolutely necessary. The spider has likewise two arms, in the fore part of its body, with which she seizes her prey.

“ Thus armed with weapons both offensive and defensive, you would imagine the spider to be secure from every enemy, and equal to every attack ; but, having no wings, it cannot save itself by flight, when it chances to meet too powerful a foe : it is therefore provided with the power of spinning a thread, which it can use as a ladder for flight, or can weave into a web to entangle and imprison its adversary. With unwearied industry, the spider commences this task at the very time when flies are first released from the egg ; forms her web in the air, through which the flies are constantly passing ; retires behind her fortifications ; and, herself invisible and secure, awaits her prey.

“ The thread formed by the spider is a silken one ; but the process by which it is made, is very different from that pursued by the silkworm. The gum, with which the spider weaves, proceeds not from the mouth, but from the lower points of the abdomen ; upon this are placed five small lumps, or teats, each of which is covered with a number of smaller ones ; and these are so many orifices, which the spider can open and shut at pleasure. These innumerable holes are the machinery for spinning. And with these a process takes place far more extraordinary than that of any common weaving : a thread issues from each of these orifices, and from the last issues a thread of peculiar fineness, which unites them all into one. With this united thread, which is supposed to consist of upwards of four thousand finer threads, the spider begins to weave. When she wants to descend, she has only to open her tubes and spin, which she does with her feet and two indented claws, guiding and separating into two distinct parcels the minute threads ; she closes the orifices when she wishes to stop ; and when she wishes to ascend, she makes use of the third claw, or spur, with the assistance of which she winds up the thread again into a ball.”

“ Really,” said Letitia, “ the spider’s powers

more than rival those of the silkworm ; it is a pity they are not exerted for a better purpose than that of entrapping poor foolish flies !”

“ The construction of the cobweb is a nice piece of architecture : when the spider has selected a suitable angle to build in, she fixes her thread to one corner of it with a little drop of her gum : she spins herself across, and fixes the other end of her thread. As this is to be the outside of her web, she passes and repasses over her thread several times, to strengthen it. From this thick thread, she draws a number of others, crossing and re-crossing the threads, and filling up the spaces by running from one to the other, and drawing her thread with her : thus she completes the fine fret-work that forms her habitation. Besides this flat web, the spider has the power of shooting up her threads to a considerable height, above her web, which she often does, in outhouses and gardens ; these threads, which are fastened to the strong outside thread of her web, shoot out in all directions, and are almost sure of entrapping the small flies which are scattered abroad, and which, when once entangled, fall down into the web below.

“ The wary spider, meanwhile, thinks it wise to hide her grim face from her prey, till they are past all escape : she forms for herself a small

silken apartment beneath the centre of the web, and quite out of sight. From this little parlour, she has two outlets, the one above, the other below; through these she visits all parts of her web, arranging and cleaning as she moves along by a shake of her tiny paw. Mark her contrivance to give her warning of the approach of her prey; there are threads drawn from every part of her web, which, like so many rays, terminate in the centre where she is stationed; the vibration of these threads when touched, in any part of them by a stray fly, gives her immediate notice; and the threads themselves serve her as a bridge, on which she can run to secure her entangled prey.

“ I must not omit the singular fact, that this gummy matter, so essential to the spider in the pursuit of its food, dries up when she becomes aged; and the disabled insect is reduced to the necessity of begging a web from some young one, which, as if it understood her wants, frequently gives it up, and spins a new one for itself. If, unhappily, the aged spider meets with no charitable young one, it must needs die of hunger.

“ I should exhaust your patience, if I were to go through all the varieties of spiders and their contrivances; I must, however, describe to you



the *garden*, or *geometric spiders*, which form their webs in a quite different, though equally singular, manner. This spider first forms her lines of five or six threads, and from these lines spins a number of smaller ones; she then passes over the lines, and draws her threads across, so as to form a centre. When she has fixed a number of these cross lines cautiously, she goes on rapidly, carrying threads round and round the centre, forming her web like a wheel. When she has carefully tried the strength of this outer circle, by pulling each thread with her feet, and repaired all the weak or broken threads, she forms little wheels within the larger one. When she has filled up the whole of her web with these small wheels, she bites away the uniting threads in the middle, and thus forms an apartment for herself in the very centre, where, having spread her snares, she has only to await her prey. Here she remains, with her head bent down; but as soon as an unhappy fly becomes entangled, she rushes forward, seizes it with her fangs, drags it to her cell, if it be a small one, sucks its juices at once, and throws the carcase away. If the fly be large, and struggles to get free, she contrives so to surround it with her threads, that its legs and wings are pinioned, and then she carries it off to her den. When the

prisoner entangled happens to be a bee, or a wasp, or too large a fly for the spider to master, the cunning insect does not attempt a battle, but will rather assist the escape of the enemy by breaking some of the threads to release it."

MISS R. remarked that she had heard of spiders' webs in the island of Bermudas, strong enough to entangle a thrush; and she had likewise read that Sir George Staunton had seen, in the island of Java, spiders' webs so strong as to require a sharp instrument to cut through them.

"The *black spider*," I continued, "inhabits cellars and vaults. It is more malignant than any other species of spider. If you make use of two little sticks to take hold of her, she will even attempt to bite the sticks. She is, in fact, the most formidable insect of the spider kind: the daring wasp, which is a deadly enemy to other spiders, cannot master her; his sting will not pierce her body; but, on the contrary, she seizes him with her pincers, and crushes him to death.

"A story is told of a woman, who took a singular delight in tormenting the black spiders in her cellar; and, every time she went down with a candle, she used to amuse herself by burning a good many. But her cruelty met with its just punishment. She imbibed the odour of the burn-

ing insects, and the fumes so affected her head, that she was perpetually subject to faintings and sickness, every object appearing to be going round. She still, however, continued her practice of tormenting the insects, till she met with the following accident: the legs of a spider, which she was going to burn, one evening, stuck in her candle; not being able to extricate itself, the body of the insect burst, and the venom shot into the eye and upon the lips of the woman; the consequence was, that her eye and mouth swelled and became inflamed; she was continually sick, and for a long time was very ill, though cured of her desire to torture spiders.

“ All the spiders, which I have mentioned, as well as every other species which weave webs, have the general name of *sedentaries*: besides which there are *vagrants*, or *wanderers*, *hunters*, and *swimmers*.

“ The *wandering spiders* are of various kinds; some there are that conceal themselves in a little cell, formed of the rolled-up leaf of a plant, where they watch and dart out upon their prey: another kind lurks behind a stone, or within the bark of a tree.

“ There is another sort, which steals into the

calyx of a dead flower, and snaps up the flies which come to seek for honey.

“The *hunters* are those which seize their prey openly ; of these, the field spider is remarkable for the length and delicacy of her legs, which raise her above the grass in which she lives, and enable her to pursue her prey.

“You must not,” continued I, “suppose that spiders exhaust all their ingenuity in forming webs to entangle and secure their prey. They likewise weave webs for the reception of their young ; and these they make five times as strong, and take a pride in reserving their best materials for them. Spiders have their good qualities, in common with most creatures ; the species of garden spider which lives under the clods of earth, carries beneath her body a tiny, round, white silken bag, about as big as a pea ; you must have observed one ; this bag contains her eggs, and is a treasure she keeps as carefully as a miser does his money bag. She carries it every where, though it is very heavy for her ; if taken away, she spares no pains to recover it ; if she cannot get it again, she gives herself up to grief ; if she recovers it, she shews the greatest joy, seizes it, and runs off with it to a place of safety.

“Nor is the affection of a spider to its young confined to the time when they are merely eggs: for, when hatched, she makes a hole in the bag, through which they spring out, and cling about the head, back, and legs of the parent, who carries them about her in this situation till they are strong enough to provide food for themselves. I have touched one of these kind parent spiders, and been highly diverted at seeing the little brood, many hundreds in number, spring from her back and run about her in every direction.

“Some spiders place their eggs in a little purse, like a leathern cap, which they fix to the wall: and they watch this treasure night and day, and will suffer themselves to be killed rather than abandon it.

“Others construct little red bags for their eggs, and place before them a bunch of leaves, to conceal them from birds and wasps, who are on the look-out for food.”

“I have heard wonderful stories of the *taran-tula spider*,” said Miss R., “whose bite is reported to occasion constant dancing and laughing; in short, a kind of mad fit, which returns every year at the time the person was bitten, and which can be stopped only by some particular music. Can you tell me if this be really the case; or only one

of the many marvellous stories related by travellers, who would sacrifice truth to the amusement of their credulous friends?"

"The tarantula is a species of spider met with in Italy, Spain, and other hot climates; its bite is accompanied with a stronger venom than that of any other spider, and occasions considerable inflammation and irritation; but as to its other reputed effects, I really believe they are mere fables.

"I shall close my account of spiders, by telling you all I can tell you about those lovely gossamer webs which delight you, Letitia, and every admirer of nature, when you take your early morning walks: but this subject, I assure you, has puzzled many a more profound inquirer than ourselves.

"It was once thought that these gossamer webs were produced by dew scorched by the sun. Many other equally strange notions have been formed about them; and you will, perhaps, think I am merely fabling, when I tell you they are nothing more nor less than air-balloons, formed by spiders, to enable them to soar into the regions of air. Seated in this aërial mansion, the spider shoots up her thread, and, when she wishes to ascend, rolls it up in the manner before described, till she gains the height she desires. Sometimes, these gossamer webs are spread over bushes, palings, and fences, to a

great extent ; at others, they sail aloft in the air, and mount to a great height. Dr. Lister, who first discovered that they were the fabric of an insect, saw them, when at the top of York Minster, far above his head. In Germany, these gossamer webs abound particularly, and are so numerous in the autumn, as to have acquired the name of the *departing summer*."

MISS R. said she had read a curious account of a sportman and his dog, who, as they were pursuing their sport in a morning, were assailed by a shower of gossamer webs, which nearly blinded or hoodwinked himself and his dogs, whenever they attempted to stir.

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### CHAPTER III.

IT was not till rather a late hour in the evening that we had concluded our discourse about spiders ; but we had no reason to repent having lengthened out the time. It was one of those lovely, calm, and clear evenings, which our variable atmosphere seldom affords us.

As we were lighted by the moon's pale crescent, I ventured to lead the ladies a little circuit home, by which, instead of the road, we had a walk by

the river side for more than half a mile; a low bushy hedge lay between us and the river, and an irregular avenue of trees on the other side of the path separated us from the meadows.

Watching the silvery light of the moon dancing upon the dimpled water, the younger part of the company had far outstripped the sober few who brought up the rear, when the whole train was stopped by a kind of shriek, or tone of mingled surprise and delight, proceeding from one or two of the foremost.

We heard ejaculations of "Beautiful!" "Curious!" and, "Oh! come and see!" And on inquiring into the cause of all this agitation, we were shewn the little sparkling lamp of the glow-worm, as it was returning from its nightly watch, sauntering among the leaves. From the glow-worm they all turned their looks to me, as I came up: "Pray, pray," said they, "tell us all about this curious little insect. How is its light made? And where does it come from?"

"If you were to take this insect home," I replied, "you would perceive that its light proceeds, not from the tail, or head, as the poets say,\*

- \* ' Disputes have been, and still prevail,  
From whence his rays proceed ;  
Some give that honour to his tail,  
And others to his head.'



but from a little pale patch near the end of its abdomen, or belly: the light seems to be formed of some phosphoric matter; but it would puzzle me to explain how it comes to be formed there.

“This glow-worm,” continued I, “(or *lam-pyris noctiluca*,) is not, like most caterpillars, the larva of an insect, but the female of a winged beetle in its most perfect state, though very different in form from its mate, which has likewise a light, though a very feeble one.

“The glow-worm has the power of putting out its light when it chooses, and is thus enabled to avoid the searching eyes of the night birds, which are ever on the watch for prey. It is said, too, that they have the power of increasing their light at times. They usually extinguish their lanterns about eleven or twelve o’clock at night.

“The race of luminous insects is an extensive, and very singular one.

“In Italy, there is a common species (the *py-golanipis Italica*,) which are winged, and, when darting through the air, look like so many brilliant stars. The beaux of Italy decorate the hair of their favourite ladies, by sticking one of these luminous insects, like a brilliant, in their hair: and, I believe in India, where they are likewise common, the same custom prevails.

“The fire fly, (or *elater noctilicus*,) has the power of emitting light in a far greater degree. This insect is about an inch in length, and a third of that in breadth. It has in its throat, two eye-like holes, out of which the light proceeds; and it has two luminous patches, visible only when the insect is flying, at which time it appears to be studded with four brilliant golden lamps. The lights emitted by the two holes in the throat alone are sufficient to enable a person to read the smallest print, if the insect be moved along the lines.

“To the natives of St. Domingo, and some of the other West-India Islands, these fire flies, at one time, supplied the place of candles in their huts. In travelling, too, they used them as lanterns, by fastening one to each great toe; besides which, they make them useful in their hunting and fishing excursions. A more important service still is performed by these fire flies; for they hunt and devour the gnats, by which those hot climates are dreadfully infested.

“In order to catch these useful insects, the natives go out in troops at night, and, armed with firebrands, ascend the neighbouring hillocks: where they beat their brands about in every direction, calling out aloud, ‘Cacue! Cacue!’ their

name for fire flies, which really obey their call, or, at least, are attracted to the place by the light. A number are thus caught, and, when carried home, are let loose into the sleeping rooms, out of which they soon clear all the gnats.

“ These pretty creatures likewise supply the natives with sport ; in the month of June, during the holiday time, they are collected and fastened all over the clothes of some of the young men, who gallop through the streets at night, on horses decorated in a similar manner, and are gazed at as a moving mountain of light. Other youthful pranks are played by smearing the face all over with the dead bodies of fire flies ; and the phosphoric light thus produced has an amusing effect.

“ The *lantern fly* is another insect, which emits a powerful light. Travellers in China and in South America describe the brilliant effect of a tree covered with these insects. Several of them were brought by the Indians to a lady, who made natural history her study. As they were brought by daylight, she observed nothing peculiar about them ; and she shut them up in a box to wait till she had leisure to make drawings of them. She put the box on the table of her sleeping-room, and in the middle of the night, being disturbed by the noise of these imprisoned insects, she opened the

box, and, to her astonishment, found it, as she thought, all in a blaze; she let it fall in her fright, and perceived that each separate insect appeared on fire.

“ One single lantern fly gives sufficient light for a person to read the newspaper by.

“ There are several other kinds of luminous insects: some are found beneath clods of earth; others flit in the air. Some of the latter are met with in this country; and it is their light which has frequently been mistaken for the *bog deceiver*, Jack-o'-lantern, or Will-o'-the-wisp, which

‘ Misleads night wanderers, laughing at their harm.’”

Having reached the white gate leading to the school-house, I took leave of my friends; but, an early day being fixed upon for the renewal of my lecture, it was not long before I found myself again surrounded by an attentive group.

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#### CHAPTER IV.

“ You must not,” I began, “ think my subject too insignificant to deserve attention, when you hear that I have selected the race of *flies* for our present entertainment. I shall begin with that kind most familiar to us, the common house fly,

(or *musca domestica*.) The structure of this little creature is as curious as that of any insect I have before described. We will examine its eyes; in appearance, they are two semicircular caps, surrounding its head; they are immoveable, but formed of an almost innumerable multitude of small surfaces, which look like fine lines crossing and recrossing each other as in lattice work, or very fine net work. In each eye, several thousand of these little planes, or surfaces, may be counted, and each plane serves as a complete eye, objects being painted upon them in the same manner as upon the retina of our own eyes.

“The fly, thus provided with eyes, which enable him to see in every direction, can guard against its numerous enemies. Its wings are formed of the most delicately glazed materials, edged with a fine fringe. Its claws have eight joints in each, and its paws are armed with several points, besides a double packet of spongy balls beneath each, whose use has been before explained.

“That delicate brush, with which her paws are provided, you must admire; with it she cleans her wings and eyes; I have seen her set to work and clean her brushes first, then rub one paw against another, and afterwards draw them first under

then over her wings, then, last of all, upon her head."

"For what purpose," asked Letitia, "is it that she takes so much trouble in cleaning herself?"

"If she were to allow all the dust and smoke she meets with in her flights to settle upon her delicate wings, they would become clogged up, and her progress through the air would be impeded. The velocity of her flight would amaze you. It is calculated that she makes with her wings 600 strokes, which carry her five feet, in a second; and it is said, that, if pursued by an enemy, she can increase her velocity seven times.

"The trunk, or *proboscis*, of the fly is composed of two parts, which fold over each other, and are sheathed with its mouth. The point is sharp enough for her to cut her meat with it; and it forms two lips, with which she takes up her food, and sucks up liquids.

Many flies have a piercer, or sting, formed of many toothed or indented pieces, and finished off at the point with fine saws; this piercer is enclosed in a sheath; and different sets of muscles enable the fly to move it forward out of the sheath and to return it to its place. Such flies as have a piercer of this description are likewise provided with a bag of corrosive water,

from which they drop a little into the hole formed by their stings.

“The species of flies which penetrate oak leaves have piercers of this description. Those which make holes in the bark of rose trees have a long tubed piercer, terminating in a bent point, like a pruning knife, with its edges indented with several ranges of teeth. With the sharp point of this piercer, the fly first traces out a line, or furrow, in the branch, into which she places her indented tube; this she twists and turns about till she cuts ranges of cells on each side of the line, in opposite pairs, like rows of teeth. With her tube, she then places an egg in each cell, which becomes, in time, a small caterpillar, and nourishes itself by feeding upon the neighbouring rose leaves.

“To return to the house fly, however; its piercer is not of that kind to enable it to pierce solid substances; it has only a tube, with which she deposits her eggs in flesh that has been softened by heat, or in moist and milky substances. From these eggs proceed myriads of worms, which change, first to aurelias, then to flies; and in this state they may be called the scourge of life. But, teasing as they are to us, when suffering from the irritable feelings occasioned by the heats of summer, as a torment, we know nothing of them com-

pared with those who inhabit warmer climates. In Spain, in Italy, in the olive districts of France, they are most annoying. They do not sting, but, as a traveller remarks, 'they teaze and worry'; your mouth, your eyes, and nose, are full of them; they swarm on every étable: fruit, sugar, milk, every thing, is attacked by them in such multitudes, that, if they are not incessantly driven away by a person, who has nothing else to do, to eat a meal is impossible.' "

MISS R. "I have heard of a troublesome little fly, which abounds in India, called the *eye fly*. It comes in the hottest season of the year, is of a black colour, exceedingly small, and flies in swarms into the eyes, causing excessive pain and inflammation."

"Of all plagues to society, in the shape of a fly, the *gnat tribe*, including *mosquitos*, is certainly the greatest. I have before alluded to the extraordinary transformations they undergo; I will now continue my history of their lives.

"You remember, that they are first introduced into the world as *aquatic* insects.—A full grown gnat is often seen gliding on the surface of the water:—and why? Because the offspring she has deposited on its brink is to be reared in it. Walk with me to the little pond in the neighbour-



ing field.—Ah! Letitia, stop! Look, look at the root of that tree, and tell me what you see. Let us take up that tiny thing. It is a perfect boat in form! Tell me, should you ever guess it was made of a parcel of gnat's eggs, glued together? If we could count the number of eggs, we should find between two and three hundred.—And this little boat will swim on the water; though hollow, it will never fill; not even if exposed to the torrent that accompanies a thunder storm.

“The eggs, thus miraculously floated, become, when first hatched, small worms, which fasten themselves by a gluey cement to some solid substance, or some chalky matter, in the water.

“In time, this worm changes its shape; it has a large head, and a tail with rough hair, which, being moistened with an oily fluid, floats on the water, and assists the insect to move on its surface.

From this state, the insect is transformed into that of a *nymph*, or pupa. It loses its head and tail; and, from the wrecks of the amphibious insect, rises a winged fly, gifted with extreme activity. Its limbs are delicately formed, its head is ornamented with a beautiful plumage; and its whole body is covered with scales and hair, to defend it from damp and dust.

The new-born fly tries her lovely wings by rubbing them against her body, or against the two bags, which hang at her side, and assist her to balance her movements.

“The sting of the gnat, I may venture to call one of the greatest wonders of nature. It is so minute, that the extreme point of it can scarcely be seen through the most powerful microscope. It is a most complicated instrument. The sheath, consisting of long scales, is fastened to the throat of the gnat. About half way down, it has an opening, out of which she can send four darts, and bring them back at pleasure. One of these darts, though pretty sharp, serves only as a sheath for the other three, whose sides are as sharp as swords, and whose tips are furnished with cutting teeth, hooked, and excessively fine. These darts are supposed to infuse a kind of venom into the wound they make, besides pumping up the blood; no wonder, therefore, if they occasion both inflammation and pain.

“The gnat shuts up the sharpest part of her instrument, when she only wants to suck the juices of fruits, and uses the sheath only, which serves every purpose of a tongue to lick up the blood, or other liquids, that the sharp darts have caused to flow.

“ In winter, this instrument becomes altogether useless ; for the gnat then ceases to eat, and passes that dreary season in holes and quarries : on the return of summer, she again sallies forth, and, seeking a pool of stagnant water, deposits on its brink, in the manner I have described, her thousands of eggs.

“ The pool is soon covered with the young ; and you, doubtless, have remarked the little dimples and circles made by their long legs upon the surface of the water.

“ This is a short history of the life of a gnat ; which, however, contrives during its existence to be one of the greatest pests of the summer season. It follows us wherever we go ; it haunts us in our easy-chairs, and contrives to enter our very bedrooms, where it banishes sleep, or awakes us by its buzzing noise, and the terrors of its sting. If we take refuge from the scorching heat of the sun in a shady arbour, the gnats still pursue us ; and if they leave it, it is only after they have pierced us with their numerous darts, irritated our blood, and spoiled our tempers.

“ This, however, is trifling, compared with what the inhabitants of foreign countries suffer from the attacks and venomous stings of gnats, or, as they are there called, *mosquitos*. No degree

either of cold or of heat is too great for them ; they swarm in Lapland, where the poor natives can neither take a mouthful of food, nor sleep in their huts, unless almost suffocated with smoke, to keep out the mosquitos ; and for the same purpose they bedaub themselves all over with tar and fish-grease : but, notwithstanding every precaution, they can with difficulty protect themselves from their bite ; neither can they breathe without having their mouths and nostrils filled with them.

“ In some parts of France, the sting has occasioned so much swelling and inflammation, as to make it doubtful if it would not be necessary to have the wounded limb cut off.

“ In the Crimea, the Russian soldiers sleep in sacks to defend themselves from the sting of the mosquito. A traveller in that country relates, that, one sultry night, during his journey, he sought refuge from these plagues in his own carriage, the window of which he did not venture to open. Swarms of them, however, made their way to him, and, though he had tied his handkerchief over his head, filled his mouth, nostrils, and ears. In the midst of his distress, he contrived to light a lamp, but it was instantaneously extinguished by a host of gnats, which filled up the glass, and a great heap lay dead round the burner.

“The buzzing noise of the mosquito is quite terrific; we can form no idea of it from the drony hum of our gnat.

“It is related, that, in America, a party of soldiers were so annoyed by mosquitos, that they were forced to make holes in the earth with their bayonets, in which they concealed their heads, while they wrapped the rest of their bodies in their hammocks.

“To magnify the evil of these mischievous insects, it seems, there are various species of them; some of which bite only in the daytime, others in the twilight, and others at night.

“After this account, the story will not appear incredible, which is related of a Persian king, who was forced to abandon the siege of a city by a plague of gnats, which attacked and put to flight his elephants.”

“Nor,” said Miss R. “shall I in future disbelieve, what before appeared to me perfect nonsense, namely, that the weapon of the gnat is more injurious to man than the jaws of the lion, or the teeth of the wolf.”

“And I,” said Letitia, “shall be more inclined to despise the pain occasioned by the bite of a single insect, even my cruel enemy the bee; and rather strive to keep in mind the gratitude we should

feel, at living in a climate in which we are, comparatively speaking, unmolested."

"I should not," continued I, "like you to leave me with the impression, that the whole of the fly tribe is alike pernicious to man; on the contrary, we derive benefits from them, for which we can hardly be sufficiently thankful. For instance, of what pleasure should we be deprived, were we without ink; the chief ingredient in which is gall, and this we owe to the anxiety of flies to deposit their eggs in safety.

"The gall insect is a fly of the *cynips* genus, or family. It is met with in greatest quantities upon a species of oak, which abounds in Asia Minor. The nuts, or little balls, are collected by the poorer inhabitants, and afterwards exported from all the sea-ports in the Levant, to the various countries of Europe.

"Those nuts which are gathered before the fly has quitted them, are called *blue galls*, and are most esteemed; when bruised, a perfect insect may be procured from the interior. Such as are gathered after the egg is hatched and the fly has escaped, contain less of the useful astringent property, and are, therefore, less valued. When each kind of gall is imported in equal quantities, they are called, in trade, *galls in sarts*. The

Aleppo and Smyrna galls, so called from the ports from which they are brought, are only another species of those pretty lumps, resembling berries, or apples, which we see on the leaves of our oak. These are all formed by an egg being deposited in the substance of the leaf, in which they grow. After the egg has been placed there, by means of the fine tube of the little winged fly, it becomes surrounded, in a few days, by a fleshy substance, which is to serve the future insect as food, defence, and shelter, during the stages of its metamorphosis.

“These pretty little insect habitations are of various forms and colours; some are round red balls, pulpy like fruit, and are eaten as such in the Levant: others are covered with a soft woolly hair, and have the appearance of seed vessels; for which they are mistaken by some people. There are others like tiny mushrooms; and some assume the shape of flowers, or artichokes; in short, there are hundreds of different forms and sizes, from that of a pin's head to that of a walnut.

“Some are attached to the leaf, some to the little foot-stalks, some to the roots, and others to the buds; while some trees are so much distorted and mis-shapen by the effect, that botanists have been puzzled to find out to what kind they belonged.

“ You have, perhaps, observed the pretty reddish mossy tufts, which appear, in autumn, upon the common wild rose briar; these too are formed by a species of the same insect.

“ The gall nut is an ingredient in dying, as well as in the making of ink.

“ Perhaps you have read of the famous Tyrian crimson dye, which was known to mankind before the time of Moses: this also was an insect product, formed from the *coccus ilicis*, which attaches itself to an evergreen oak, now common in the south of France and other countries. Another species of the same insect, the cochineal fly, (or *coccus cacti*,) produces us our scarlet, the most valuable dye we have.

“ This insect is chiefly cultivated in Mexico; where it feeds upon a species of Indian fig, called the *cochineal plant*, or, by the Indians, *nopal*. The leaves of this plant are thick, succulent, and thorny. In Oaxaca, the district in which cochineal is chiefly cultivated, the nopals are formed into plantations, each plantation containing upwards of 50,000 trees, set in rows, which are not allowed to grow above four feet in height. Just before the rainy season commences, the cultivators, or *nopaleros*, as they are there called, sweep away a number of very small insects, which have been



feeding upon the green succulent leaves of the trees. These they carefully preserve in their houses, and supply them with leaves of the same trees for their support. At the end of the rainy season, about a dozen of the insects together are put into small baskets, made on purpose, of moss, or of the woolly down of the cocoa nut.

“ These little baskets are placed upon the plant, the most prickly variety of which is chosen, as affording the cochineal most protection from birds and insects ; and the flower and fruit are carefully stripped off, to prevent them from laying their eggs within them.

“ Here the cochineals fatten, and, soon after, deposit their eggs in great abundance, and die. This affords the first crop, though the least valuable one to the cochineal cultivator. The young insects, when hatched, forsake their baskets, and, spreading all over the plants, fatten rapidly. In three months’ time, they deposit eggs ; and, in their turn, are swept off and carried home by the nopalese ; who, after gathering three of these crops in the course of the year, take the old insects under shelter, as before described. Of these, they preserve sufficient to produce a future stock of eggs ; the rest are destroyed.

“ Upon the method of killing these insects, their value, in part, depends. Some are baked in

the ovens, which the Indian women use for heating their vapour baths: others are immersed in hot water; others are burnt upon the flat stoves, upon which the American women bake their bread. The first method is considered best to preserve the colour of the insect, whose body is filled with the beautiful red dust, which constitutes the dye.

“The operation of brushing off the cochineal fly from the Indian fig-tree is exceedingly tedious; it is performed with the tail of a stag, or of a squirrel, by the American women, who squat down beside a single plant for hours together: what labour, therefore, it must be to brush them from a whole plantation!

“This insect, so minute that its body and paws can scarcely be discerned with the aid of a microscope, affords a produce of £50,000, annually, to its South American cultivators! You *must* recal your term *useless*, Miss Letitia.

“There is another insect produce, called *lac*, which is gathered abundantly in India. It is the produce of an insect of the *coccus* species, which collects a gummy substance from various flowers, and deposits it on the branches of trees. In India, lac is manufactured into beads, rings, and other female ornaments; or, it is mixed with sand, and formed into grinding stones.

“Melted in water with a little borax, and mix-

ed up with lamp or ivory black, lac makes an excellent ink. It is brought in various forms to this country, where it is chiefly used in making varnish and sealing wax; but it has recently been used as a substitute for cochineal, in the red dye.

“Doubtless, there are many other insects, which would afford a dye; and, probably, our own woods abound in larvæ sufficient to supply all our wants of that kind, had we patience and perseverance enough to make the search.”

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I here closed my lecture for the evening; and, as the event proved, ended the intercourse with my young friends altogether. Autumn was, by this time, pretty far advanced, and the rainy season had commenced; the nymphs of the white house could no longer stroll to my cottage; and I returned to town, well pleased with the recreations of the summer at Long Hampton.

THE END.



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